MAGNESIUM DEFICIENCY AND METABOLIC SYNDROME X

According to Dr. Resnick, syndrome X is caused not by chronically elevated insulin levels but by a low level of magnesium ions—because insufficient magnesium is the cause of insulin resistance in the first place.[9] As stated, insulin opens the cells to glucose only if the cells have sufficient amounts of magnesium, and without magnesium, insulin resistance occurs. Studies clearly show that animals deprived of dietary magnesium develop insulin resistance, and the human population has the same risk.[10] Some researchers conclude that hypertension and insulin resistance may just be different expressions of deficient levels of cellular magnesium.[11] The various conditions that make up syndrome X, CVMS, or metabolic syndrome X, its most recent designation, all have similar origins in magnesium deficiency.

The magnesium deficiency in syndrome X comes from a combination of our magnesium-deficient diet and the well-documented loss of magnesium in the urine caused by elevated insulin. A vicious cycle creates further magnesium losses, causing more syndrome X symptoms. In a fifteen-year study of 5,000 young adults, it was found that the more magnesium in the diet or taken as supplements, the lower the likelihood of developing metabolic syndrome.[12]

The cornerstone of both prevention and treatment of syndrome X, along with diet, is to restore magnesium to normal levels. Unfortunately, for many, the ravages of diabetes, hypertension, and high cholesterol have taken their toll, but even then, magnesium taken along with

medications can play a beneficial role in controlling and reducing symptoms.[13], [14]

DIABETES

Diabetes is the seventh-leading cause of death in this country. There are 16 million diabetics in the United States, with the numbers increasing dramatically as the population gets older and as more young people succumb to a high-sugar diet. There are two main types of diabetes. About 10 percent of diabetics are labeled type I and are dependent on insulin. Type I diabetes usually develops in children; they may have suffered a viral infection of the pancreas, resulting in impaired or absent insulin production, and require insulin injections to replace their loss. Type II or adult-onset diabetics tend to be non-insulin-dependent, overweight, and between fifty and seventy years old at onset. In type II diabetes, insulin is readily available—in fact, it is usually elevated—but the cells of the body appear to be resistant to it. Insulin is unable to do its job of opening up the cell membrane to allow the passage of glucose into the cell to create energy.

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM AND DIABETES

1. Magnesium deficiency may be an independent predictor of diabetes.

2. Diabetics both need more magnesium and lose more than most people.

3. Magnesium is necessary for the production,

function, and transport of insulin.

A third type of diabetes, gestational diabetes, is usually shortlived. This glucose intolerance may have been present but undetected before pregnancy but usually develops due to the stresses of pregnancy. Ionized Magnesium Testing demonstrates the presence of magnesium depletion in pregnancy itself and to a greater extent in gestational diabetes. However, Ionized Magnesium Testing remains available only as a research tool; the next best option is a Magnesium RBC test or an EXATest, either of which is vitally important in diagnosing magnesium deficiency in gestational diabetes. (See Resources for more information.) Magnesium depletion, or relative calcium excess, may predispose women to vascular complications of pregnancy and needs to be addressed.[15] Intervention with magnesium supplements can greatly improve the outcome for both mother and baby.

The signs and symptoms of diabetes are polydipsia (excessive thirst), polyuria (excessive urination), and polyphagia (excessive eating). In type I diabetes, weight loss may be the first sign, but type II diabetics are usually overweight. The excessive urination carries both sugar and magnesium out of the body. The excessive sugar, excreted through the urine and sweat, provides food for the yeast organism *Candida albicans*, resulting in rashes on the skin (especially under the breasts and in the groin area), yeast vaginitis in women, and yeast discharge in men.

Common complications of diabetes include nerve

damage, called diabetic neuropathy, which mostly affects the feet, with symptoms of numbness, tingling, burning, and pain; atherosclerosis and heart attacks; damage to small blood vessels in the eyes and kidneys, causing vision loss (diabetes is the leading cause of blindness in the United States) and kidney disease; diabetic foot ulcers, with increased susceptibility to infection, gangrene, and amputation; and impotence in men. All these complications relate to magnesium deficiency and demonstrate the need for sensitive magnesium testing and magnesium supplementation for diabetes.[16]

One diabetic complication that may not be obvious is the tendency for doctors to put diabetics on statin medication. Because diabetes and elevated cholesterol are associated, drug companies promote the use of statins, presumably as a preventive measure. This, however, may not be such a good idea for people who are already suffering symptoms of magnesium deficiency.

Low magnesium levels serve as a relatively new marker for diabetes, occurring in up to 40 percent of diabetic patients.[17], [18], [19] However, if some doctors are skeptical, no one can deny the results from three of the largest studies on the incidence of diseases, the Harvard Nurses' Health Study of 85,000 women, the 43,000 men in the Health Professionals Follow-Up Study, and another 40,000 women in the Iowa Women's Health Study. All three studies observed that people with the highest levels of the mineral magnesium in their diets have the lowest risk for developing diabetes. It's important that this information be promoted more widely.

DIABETIC COMPLICATIONS AND MAGNESIUM

Lack of magnesium increases the risk of cardiovascular disease, eye symptoms, and nerve damage in diabetics, whereas supplementation can prevent them.[20], [21], [22] Magnesium is a necessary cofactor in the production of energy from sugar stores in the muscles and liver. Most important for diabetics, insulin's main job requires magnesium; without magnesium, insulin is not properly secreted from the pancreas, and what does get into the bloodstream doesn't work correctly. At the cell level, magnesium is required to open pathways into the cell for the entrance of blood sugar. If magnesium is in short supply, sugar stays in the bloodstream, and as it becomes elevated, symptoms of diabetes appear. One of the symptoms of diabetes is copious urination—magnesium levels are elevated in diabetic urine, which means greater losses and more symptoms in a vicious cycle of depletion.

Studies show that even moderate improvement of blood sugar control in patients with type I diabetes seems to reduce the loss of magnesium, increase serum HDL cholesterol (the "good" cholesterol), and decrease serum triglycerides. These reductions in magnesium loss and serum triglycerides and the elevation of good cholesterol may reduce the risk of developing cardiovascular disease in patients with type I diabetes.[23]

DIABETES AND CHILDREN

In his book *Transdermal Magnesium Therapy*, Mark Sircus, O.M.D., asks the question, "Is a lack of magnesium related to type 2 diabetes in obese children?" He answers by reporting on a study by Dr. Huerta showing that magnesium deficiency is associated with insulin resistance in obese children. When checking the dietary intake of magnesium, Dr. Huerta and her colleagues found that 55 percent of obese children did not get enough magnesium from the foods they ate, compared with only 27 percent of nonobese children.

HOW DID WE BECOME A NATION OF DIABETICS?

In non-Western cultures, where most traditional diets are composed largely of unprocessed foods and are low in sugar, it takes only one generation of people eating a more typical Western diet high in sugar and refined flour to develop diabetes. This is true of people around the world, from the Inuit to secluded African peoples. The immediate advice given to a newly diagnosed diabetic is to stop eating sugar and other refined carbohydrates. It is only common sense that avoiding these unhealthy nonfoods as a preventive measure could greatly reduce the incidence of diabetes, yet the medical community has been slow to promote this idea.

Partly as a result, both obesity and type II diabetes are on the rise in children. In the last decade, soft drink consumption has almost doubled among kids, adding an average of 15 to 20 extra teaspoon of sugar a day just from soda and other sugared drinks. These all-too-popular beverages account for more than a quarter of all drinks consumed in the United States. More than 15 billion gallons were sold in 2000.[24] A 2001 report in the prestigious medical journal *The Lancet* revealed that each additional soft drink a day gives a child a 60 percent greater chance of becoming obese.[25] Dr. France Bellisle, of France's Institute of Health and Medical Research, said the study provided convincing new evidence about the relationship between sugar and weight gain in children. It is unfortunate that it has taken so long for the *first* study on sugar and weight gain to be funded and published—so many children and adults are already addicted to sugar, and there is no turning

back. Surprisingly, not until diabetes strikes does any medical body recommend cutting back on sugar intake.

LABORATORY FINDINGS IN DIABETES

- Blood glucose greater than or equal to 200 mg/dl (11.1 mmol/L) two hours after an oral dose of 75 g of glucose dissolved in water
- Incidental blood glucose greater than or equal to 200 mg/dl (11.1 mmol/L) in someone with signs and symptoms of diabetes
- High cholesterol
- Low magnesium ions

We know from other important research that obese children develop insulin resistance, a precursor to diabetes, fifty-three times more frequently than normal kids. The number of obese children in the United States doubled between 1980 and 1994; today 24 percent of kids are obese. Recently there has been a 70 percent rise in diabetes in thirty-year-olds, and the trend shows no sign of abating.

As a nation, we eat 140 pounds of sugar per year per person, so it is no wonder that more and more people are developing symptoms of diabetes and insulin resistance and suffering from magnesium deficiency. Even more shocking

are studies in both animals and healthy adults that demonstrate a greatly depressed immune response to infection that lasts for more than five hours after the ingestion of 20 tsp of sugar.[26], [27], [28] Part of the danger with sugar is that you may not even realize how much you are ingesting. On ingredient labels, the measurements are given in grams, even though most Americans think in teaspoons, so our eyes may not even register the amounts. People are stunned when told there are 8 to 10 tsp of sugar in an ordinary soda (1 tsp of sugar is equivalent to 4.2 g). Even more shocking is the amount of sugar found in most single servings of sweetened yogurt, which most people think of as a health food.

Sugar overload can cause magnesium deficiency in several ways. Processed sugar is devoid of vitamins and minerals, leaving empty calories that provide no valuable nutrients. Nutritional research reported by Dr. Abram Hoffer (the originator, with Linus Pauling, of orthomolecular medicine) shows that the refining of sugar removes 93 percent of chromium, 89 percent of manganese, 98 percent of cobalt, 83 percent of copper, 98 percent of zinc, and 98 percent of magnesium. All these minerals are essential to life. In addition, the body has to tap into its own reserves of minerals and vitamins to ensure sugar's digestion.

Inability to utilize sugar results in the formation of toxic products such as pyruvic acid and other abnormal sugars that accumulate in the brain, nervous system, and red blood cells, where they interfere with cell respiration and hasten degenerative disease. Adding sugar to the diet produces an

excessively acid condition in the body; to neutralize it the body has to draw upon its stores of the alkaline minerals calcium, magnesium, and potassium. If the acidic condition is severe, calcium and magnesium will even be taken from the bones and teeth, which leads to decay, softening, and ultimately osteoporosis. In summary, magnesium plays a pivotal role in the secretion and function of insulin; without it, diabetes is inevitable. Measurable magnesium deficiency is common in diabetes and in many of its complications, including heart disease, eye damage, high blood pressure, and obesity. When the treatment of diabetes includes magnesium, these problems are prevented or minimized.[29] And we do know that magnesium-rich water in certain communities confers a protective effect against the disease.[30], [31] Magnesium supplementation improves insulin response, improves glucose tolerance, and reduces the stickiness of red blood cell membranes. Magnesium also seems to be essential in the treatment of peripheral vascular disease associated with diabetes.[32] With long-term damage, however, many symptoms may be irreversible, even with adequate magnesium and associated nutrients.

DIET FOR DIABETES

The proper diet for the prevention and treatment of diabetes includes frequent small meals of protein (fish—especially wild salmon, to avoid mercury—and free-range chicken and meat) and complex carbohydrates (whole grains, legumes, and vegetables), as well as the avoidance of simple sugars and white flour. Stevia, from the leaves of a plant that grows in South America, is the best sweetener to use. You can find it in health food stores. Don't use the sugar substitute aspartame, which can worsen blood sugar control and cause weight gain, headaches, nerve damage, and eye damage, because it is made partly from wood alcohol, which breaks down to formaldehyde.[33] Fiber from oat bran, flaxseed, and apples has a positive effect on keeping blood sugar balanced. Also read *The Yeast Connection and Women's Health* (Crook and Dean, 2005) and *IBS for Dummies* (Dean and Wheeler, 2005).

Alternative medicine practitioners also suggest identifying any existing food allergies by eliminating likely suspects (dairy, wheat, corn) from the diet for several days and then eating several meals of one of the suspected foods in one day or doing a blood test or finger stick for glucose. (*Warning:* do not eat several meals consisting of foods to which you have reacted strongly in the past. Simply keep avoiding them.) If the blood sugar is elevated after eating a particular food, it may be wise to avoid that food and find replacements that do not elevate the blood sugar.

SUPPLEMENTS FOR DIABETES

ReMag: (Picometer-ionic) 150 mg 2–3 times a day and/or

Magnesium taurate: 125 mg three or four times per day

Vitamin E, as mixed tocopherols: 400 IU twice a day

Rutin or quercetin (bioflavonoids): 500 mg daily

Folic acid: 800 mcg daily

Vitamin B complex: 2 per day. Food-based, Grown by Nature or Natural Vitality

Vitamin C: 1,000 mg three times a day

Vitamin D: 1,000 IU or 20 minutes in the sun daily

Calcium: dietary and/or bone broth, 700mg (see this page for food lists and this page for bone broth recipe]

ReLyte: Mineral-Electrolyte Solution: ½ tsp three times a day

Omega-3 fatty acids: 3 g daily

Garlic: one or two cloves daily

CHAPTER NINE

PMS, DYSMENORRHEA, AND POLYCYSTIC OVARIAN SYNDROME

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM AND PMS

1. Chocolate, which some women have a craving for when they're premenstrual, contains high amounts of magnesium, but the added sugar and fat make it far less desirable as a food.

2. The patent for Prozac has run out, so it has been patented under a new name, Serafem, for PMS. PMS is not caused by a Serafem deficiency, but magnesium deficiency can cause some forms of PMS.

3. Magnesium is a safe treatment for PMS and PMS headaches.

Maureen didn't know what came over her every month, but she would get anxious and irritable and go on a chocolate binge. She tried to keep it to herself, but lately the other

women at work had begun to make not-so-subtle comments and tease her about her "evil twin." Then Anna sat with her over lunch one day and told her about a support group she was leading for women with premenstrual syndrome. One of their self-help methods was to keep a journal of symptoms. Maureen's journal for the next couple of months clearly showed that her symptoms of anxiety, fluid retention, sugar and chocolate cravings, mood swings, irritability, bloating, edema, headache, and sore breasts escalated before her period and lifted the minute her period began.

Taking magnesium supplements may be the solution for PMS, advises Melvyn Werbach, M.D. Recent studies showed that of 192 women taking 400 mg of magnesium daily for PMS, 95 percent experienced less breast pain and had less weight gain, 89 percent suffered less nervous tension, and 43 percent had fewer headaches. (Dr. Werbach and several other researchers also advise that women should take 50 mg of vitamin B_6 daily with the magnesium to assist in magnesium absorption.)[1] Magnesium RBC tests show low levels of magnesium in women with PMS.[2] Even serum magnesium levels, which are low only when there is a severe magnesium deficiency, diminished significantly in the premenstrual week in a group of forty women.[3] In a small trial of thirty-two women, oral magnesium was found to be an effective treatment of premenstrual symptoms related to mood changes.[4] Treatment with magnesium eases headaches, sugar cravings, low blood sugar, and dizziness related to PMS.[5], [6]

In another innovative research study, magnesium ion

levels were taken at several times during normal menstrual cycles to determine magnesium and calcium levels in relation to menstrual phases.[7] There was a comparatively high magnesium ion level in the first week after the onset of the period, a statistically significant decrease in magnesium ions around the time of ovulation, and a large decrease in magnesium ions and serum magnesium when the serum progesterone concentration peaked in the third week. There was also a significant increase in the serum calcium-to-magnesium ratio both at the time of ovulation and in the fourth week after the onset of the period. That calcium-to-magnesium imbalance can cause premenstrual symptoms during the last week of the menstrual cycle. The good news is that you can take care of it easily with the right amounts of calcium and magnesium. For most women this translates into 500–700 mg calcium and 500–1,000 mg of magnesium each a day in divided doses. Most of your calcium can come from foods: dairy, greens, whole grains, nuts, seeds and bone broth (see recipe on this page).

An elegant study demonstrates that estrogen and progesterone, the female sex hormones, influence magnesium ion levels in the body, which may help explain why magnesium relieves symptoms of PMS, including migraine, bloating, and edema.[8] Exposure of cultured smooth muscle cells from brain blood vessels to a low concentration of estrogen did not interfere with the level of magnesium ions. However, exposure to increased concentrations of estrogen induced significant loss of magnesium ions; at the highest concentration, the level of magnesium ions decreased approximately 30 percent in

comparison with controls. Exposure of the cultured cells to a low concentration of progesterone resulted in an increased level of magnesium ions. However, when these cells were exposed to higher concentrations of progesterone, cellular levels of magnesium ions decreased significantly. The higher the estrogen or progesterone concentration, the lower the levels of magnesium ions.

The data in this experiment indicate that the normally low concentrations of the female sex hormones, estrogen and progesterone, help cerebral vascular smooth muscle cells sustain normal concentrations of magnesium ions, which are beneficial to vascular function, whereas high levels of estrogen and progesterone significantly deplete magnesium ions, possibly resulting in cerebral vessel spasms and reduced cerebral blood flow—and thus leading to premenstrual syndrome and migraine and possible stroke risk. These findings help to explain why more women than men suffer migraines and why migraines occur more frequently in the second half of the menstrual cycle, when estrogen and progesterone are both elevated.

Guy Abraham, M.D., a retired obstetrician and gynecologist, is a widely published author who has pursued major research on premenstrual syndrome. Dr. Abraham identifies four types of PMS, each of which has distinct characteristics related to hormonal fluctuations.

1. PMS-A (anxiety), with symptoms of mood swings, nervous tension, irritability, anxiety. Related to high estrogen, low progesterone.
2. PMS-C (craving), with symptoms of increased

appetite, headache, fatigue, dizziness, fainting, palpitations. Related to increased carbohydrate intake and decreased prostaglandin E1–type foods (from fish, nuts, seeds).

3. PMS-D (depression), with symptoms of depression, crying, forgetfulness, confusion, insomnia. Related to low estrogen, high progesterone, elevated male hormone with excess hair growth.

4. PMS-H (hyperhydration), with symptoms of fluid retention, weight gain, swollen extremities, breast tenderness, abdominal bloating. Related to excess aldosterone (a kidney hormone that causes fluid retention).

Maureen had symptoms from three of the four groups. Her successful treatment involved balancing hormones and replacing deficient nutrients. She began to take a daily tablespoon of flaxseed oil, which contains omega-3 essential fatty acids, along with magnesium, vitamin B_6, and increased her dietary calcium. Essential fatty acids are necessary building blocks for hormone production as long as they have magnesium and B vitamins as cofactors.

PMS AND YOUR DIET

A fascinating diet review shows that women suffering from PMS followed diets that were

- 275 percent higher in refined sugar
- 79 percent higher in dairy products
- 78 percent higher in sodium
- 77 percent lower in magnesium
- 63 percent higher in refined carbohydrates
- 53 percent lower in iron
- 52 percent lower in zinc[9]

Ounce for ounce, chocolate has more magnesium than any other food, and the irresistible urge to consume chocolate is a sure sign of magnesium deficiency. Premenstrual chocolate craving is widespread because magnesium is at its lowest around that time of a woman's menses. The answer is not to eat more chocolate, however, but to increase magnesium intake by eating more nuts, whole grains, seafood, and green vegetables, and by taking magnesium supplements. The chocolate cravings will vanish when there is enough magnesium in the diet.

Other foods to consume in moderation are beef and chicken, which are frequently treated with synthetic hormones. Remember that one type of PMS occurs when there is too much estrogen and too little progesterone in a woman's body. It is possible to end up with too much estrogen stimulation by eating, drinking, or breathing synthetic hormones, pesticides, or other chemical residues

that mimic estrogen. The saturated fat and arachidonic acid in meat also suppress progesterone production and cause symptoms of inflammation that worsen PMS and can lead to painful periods. Essential fatty acids—from fish, nuts, and seeds, including flaxseed—are much healthier fats and help prevent PMS, unless you have a magnesium deficiency. Without magnesium, essential fatty acids are not processed properly and are not able to calm the irritability and inflammation of PMS and painful periods. Magnesium deficiency is created by stress, which is common to PMS sufferers. The only solution to this vicious circle is to eat a healthy diet—organic, if possible—and take nutrient supplements that include magnesium.

PMS AND DEPRESSION

Women can get depressed before their period, but PMS is not just depression. Yet PMS is often considered by medical doctors and pharmaceutical companies to be a psychiatric condition suitable for treatment with selective serotonin reuptake inhibitors such as fluoxetine (Prozac, Serafem). But remember that a lack of fluoxetine does not cause PMS symptoms; a lack of magnesium does. The replacement of magnesium in the body will treat PMS and cause no side effects. In fact, it has also been found that magnesium relieves the depression of premenstrual syndrome by positively influencing serotonin activity naturally. Serafem can make no such claim.

TREATMENT FOR PMS

DIET

Increase complex carbohydrates and fiber.
Reduce saturated fats, particularly red meat and dairy.
Eliminate caffeine and alcohol.
Reduce salt intake.
Eliminate sugar.

SUPPLEMENTS FOR PMS

ReMag: (Picometer-ionic) 150 mg 2–3 times a day and/or

Magnesium citrate: 300–600 mg daily

Vitamin B complex: 2 per day. Food-based, Grown by Nature or Natural Vitality

Vitamin E, as mixed tocopherols: 400 IU daily

Essential fatty acids: flaxseed oil, 1 tbsp twice per day, or evening primrose oil, 500 mg three times per day

Calcium: dietary and/or bone broth, 700mg (see this page for food lists and this page for bone broth recipe)

Milk thistle: 250 mg three times a day, to detox the liver

Progesterone: ¼ tsp twice a day rubbed into the skin (rotate among inner thighs, stomach, inner arms). Use natural progesterone cream derived from wild yam to balance excess estrogen. It should contain USP progesterone 450–500 mg/oz. (Before using progesterone cream, have a naturopathic doctor

evaluate your hormones by testing levels in your saliva and retest every three to four months to avoid overdosing, which can deplete magnesium.)

DYSMENORRHEA (PAINFUL PERIODS)

Calcium can act like a painkiller and relaxant, but it may accomplish this by driving magnesium out of the cells and into the bloodstream, where it is able to be directed toward ailing tissues to treat pain. So taking calcium can alleviate menstrual cramps in this way—until you become magnesium-depleted. Taking magnesium *before* your period may forestall the pain altogether. A series of European studies with small groups of women who suffered painful periods consistently showed relief of symptoms when they took high doses of magnesium.[10], [11], [12] Take 700 mg of dietary calcium with 700 mg of supplemental magnesium Use non-laxative ReMag. Calcium supplements are only about 4 percent absorbed so end up precipitating out and causing problems (atherosclerosis, gall stones, kidney stones, breast tissue calcification, fibromyalgia). Extra magnesium can also be taken when the pain is at its worst (300 mg once or twice a day for a total of 900–1,200 mg).

Some women find that decreasing their intake of meat before their period helps prevent cramps. What may not be obvious is that when you cut back on meat you have a better chance of eating more magnesium-rich foods that will ease symptoms of painful periods.

POLYCYSTIC OVARIAN SYNDROME

Polycystic ovarian syndrome (PCOS) patients have a high incidence of insulin resistance and glucose intolerance. In a recent telephone consultation, a young woman told me she had been advised to go on diabetes drugs, not because she has diabetes but because she has PCOS and the drugs were supposed to lower her insulin resistance. PCOS patients also tend to be at risk for hypertension, diabetes, and heart disease. Since a low magnesium ion level and a high calcium/magnesium ratio are associated with insulin resistance, cardiovascular problems, diabetes mellitus, and hypertension, a study was done on a group of PCOS patients to determine the effects of magnesium intervention. Significantly lower levels of magnesium ions and serum magnesium and a significantly higher calcium-ion-to-magnesium-ion ratio were found in the PCOS patients compared with the controls, which gave me enough evidence to recommend she speak to her doctor about taking a magnesium citrate supplement of 300 mg twice per day to treat her insulin resistance and possibly her PCOS as well.[13]

CHAPTER TEN

INFERTILITY, PREGNANCY, PREECLAMPSIA, AND CEREBRAL PALSY

Advice passed down through generations of midwives includes giving Epsom salts (magnesium sulfate) throughout pregnancy. Therefore it comes as no surprise that magnesium is an important part of the whole miracle of ushering new life into the world. Conception, pregnancy, and delivery are times when nature, nutrients, and nurturing are the prescription, not drug intervention. I learned this important lesson from the astonishing results in the delivery suite when IV magnesium was used to stop seizures and lower high blood pressure. This powerful yet safe medicine can do much more than we currently allow.

INFERTILITY

The Pottenger Cat Study is very instructive on the absolute requirement for good nutrition in pregnancy. Francis M. Pottenger, M.D., beginning in 1932, ran a ten-year nutritional experiment on several groups of cats. He fed one group heat-processed food and another group raw meat and raw milk. The cats fed cooked food became infertile by the third generation, in contrast to those eating the raw food diet. This simple study underscores the importance not just of magnesium but of all nutrients in producing a viable pregnancy. We know that heating food past the boiling point destroys vitamins and burns off magnesium and enzymes. Most minerals may be left, but the vital balance with other nutrients is ultimately lost.

Dr. Sherry Rogers, a diplomate in family practice, allergy-asthma-immunology, and environmental medicine and a fellow of the American College of Nutrition, says that just as migraines are caused by spasms in the brain arteries, spasms in the fallopian tubes cause infertility. This may explain why so many infertile women get pregnant when they go on a whole-foods diet and take supplements including magnesium.[1] Magnesium is required in higher amounts during pregnancy.[2] So taking it to enhance conception also creates a healthier pregnancy.

It also appears that male infertility is associated with magnesium deficiency. Both magnesium and zinc are found in very significant amounts in seminal fluid. However, infertile men have much lower levels of magnesium, especially when they also have chronic prostatitis or prostate infection.[3]

SEIZURES IN THE DELIVERY SUITE

Marie was not having an easy pregnancy. She had gained too much weight, she had headaches, and her ankles and hands were swollen. She also felt a tightness in her head and shortness of breath. At her eight-month visit to the doctor, her blood pressure was elevated, she had hyperactive reflexes, and her urine showed protein—all symptoms of preeclampsia (also called pregnancy-induced hypertension or toxemia). Preeclampsia occurs in 7 percent of all pregnancies and, according to the Preeclampsia Foundation, is responsible for at least 76,000 maternal deaths worldwide each year. A rapidly progressive condition characterized by high blood pressure, hyperactive reflexes, edema, headaches, changes in vision, and protein in the urine, it can escalate and cause seizures, at which point it is called eclampsia.

Eclampsia is a serious condition that can cause premature labor, premature birth, and cerebral palsy in the newborn. Marie's doctor said that bed rest was the only solution to lower her blood pressure but that if she continued to have high blood pressure around the time of delivery, he would give her intravenous magnesium. Unfortunately, he did not have her current magnesium levels tested. Many researchers and clinicians recommend that pregnant women have a Magnesium RBC test or EXATest and take 300–600 mg of supplemental magnesium.[4], [5], [6] (Always check with your obstetrician or health care provider before adding any supplement, but know that magnesium has a long history of safety for both mother and child.)

Although magnesium is the treatment of choice for pregnancy-induced hypertension, it could be used more widely. Many researchers suggest that pregnant mothers routinely take magnesium throughout pregnancy to prevent complications during delivery and postpartum, and to help prevent premature births.[7] Clinical trials have demonstrated that mothers supplementing with magnesium oxide have larger, healthier babies and lower rates of preeclampsia, premature labor, sudden infant death, and birth defects, including cerebral palsy.[8] What has become apparent in recent studies, however, is that only 4 percent of magnesium oxide is absorbed and utilized in the body. (In Chapter 18 the various types of magnesium products that are available are listed to help you decide which one is best for you.) Fortunately, Marie consulted a midwife specializing in preeclampsia, who was familiar with the use of magnesium in pregnancy. They checked the label of Marie's prenatal supplement and found that it contained only 150 mg of magnesium; she really needed at least 360 mg just to meet the RDA for pregnant women. The midwife recommended that Marie take a magnesium supplement to give her a total of 400 mg of elemental magnesium per day and that she increase her intake of magnesium-rich foods.

Magnesium sulfate given intravenously for eclampsia has been used successfully for more than seventy-five years.[9] In the 1960s, the advent of new diuretics and anticonvulsant drugs threatened to displace magnesium sulfate. Drug companies continue to run expensive

clinical trials to compare their newest antihypertensives and anticonvulsants to magnesium sulfate. Most studies show that magnesium is, in fact, more effective than synthetic medications, decreases both infant and maternal mortality, and is extremely safe. As one researcher remarked, "The significant improvement in fetal outcome with dietary magnesium supports the concept of magnesium supplementation during pregnancy."[10]

On this new regimen, Marie noticed many positive changes. She had less back and neck tension, was no longer constipated (a common side effect of pregnancy), had more energy, and lost her edema and puffiness. Finally, the tightness in her head lessened and her blood pressure began to go down. When she told all this to her obstetrician, he actually apologized for not being more aware of her magnesium status and said it was a good reminder for him to be more diligent about the amount of magnesium in his patients' prenatal supplements.

SIDS

Magnesium deficiency has been implicated in sudden infant death syndrome (SIDS), which has features in common with sudden cardiac death of adults[11] and may be prevented by giving adequate magnesium to the mother and child.[12] An episode of muscular weakness induced by magnesium deficiency could prevent a distressed infant from turning its head when lying facedown and thus result in suffocation.[13]

The triple-risk model for SIDS describes the intersection of three potential risks: (1) a vulnerable newborn who is magnesium-deficient, (2) a critical adjustment and development period in a newborn displaying hyperirritability and unsettled cardiovascular and respiratory control, and (3) an outside stressor such as high-pitched noise, excessive motion or handling, chill, fever, or vaccination. Together, these three risks may trigger a shocklike episode of apnea, unconsciousness, and slow heart rate. Researchers feel that it is likely that a high proportion of SIDS deaths could be prevented by simple oral magnesium supplementation to infants during the first critical weeks and months of life.[14] This could be given in the form of a magnesium citrate powder or picometer magnesium in a bottle of water.

Dr. Jean Durlach, a professor at St. Vincent de Paul Hospital in Paris and president of the International Society for the Development of Research on Magnesium (SDRM), states, “This simple and cheap supplementation with doses of 300 milligrams per day to the mother is ethically justifiable. Furthermore the beneficial effects of magnesium

supplementation are well established for the mother, for fetal development, and for the baby at birth." He calls for a large clinical trial of magnesium supplementation in pregnant and breast-feeding women.[15]

CEREBRAL PALSY

Cerebral palsy (CP) can occur when there is a fetal brain hemorrhage during the last stages of pregnancy, either from the mother's high blood pressure or from a lack of oxygen to the developing baby's brain. It can also be caused by low birth weight and prematurity. In cerebral palsy, the brain is damaged in such a way that it is unable to properly direct muscle function. The brain gives the muscles contradictory signals, and as a result, the muscles lock and become spastic or go limp, creating a disabling and incurable condition. Close to half the infants born with CP also have mental handicaps. Very-low-birth-weight babies (less than 1,500 g, or 3.3 lbs) are a hundred times more likely to have disabling CP than infants of average birth weight (3,000–3,500 g); more than 25 percent of all CP occurs in very-low-birth-weight babies. More than half a million Americans suffer from CP, with estimated medical costs of $5 billion a year.

Since there is no treatment for CP, preventing cerebral palsy would be "very desirable indeed," asserts neurologist Karin B. Nelson of the National Institutes of Health in Bethesda, Maryland. Dr. Nelson and her colleagues concluded a groundbreaking study in 1995 showing that very-low-birth-weight babies in four centers in California had a lower incidence of cerebral palsy when their mothers were treated with magnesium sulfate shortly before giving birth.[16] "This intriguing finding means that use of a simple medication could significantly decrease the incidence of cerebral palsy and prevent lifelong disability and suffering for thousands of Americans," said Zach W. Hall, Ph.D.,

director of the National Institute of Neurological Disorders and Stroke. The researchers calculated that magnesium sulfate reduced the prevalence of cerebral palsy by about 90 percent and reduced the prevalence of mental retardation by about 70 percent. They speculate that magnesium may play a role in brain development and possibly prevent cerebral hemorrhage in preterm infants.

Dr. Diane Schendel found very similar results the following year while studying a population in Atlanta.[17] Those mothers receiving magnesium sulfate delivered infants with a 90 percent lower prevalence of cerebral palsy and a 70 percent lower prevalence of mental retardation. The researchers reported that at one year of age, only 1 out of 113 babies whose mothers received magnesium sulfate developed cerebral palsy. Only two of the babies had mental handicaps. In contrast, 30 of the 405 children whose mothers did not receive magnesium sulfate had cerebral palsy and 22 had handicaps. The investigators speculated that magnesium may prevent fetal brain hemorrhage or block the harmful effects of a diminished oxygen supply to the brain. And for those babies exposed to too much oxygen in an attempt to overcome intrauterine deficits, magnesium protects the lungs.[18] A recent literature review and new research suggest that magnesium chloride might be even more protective for the developing brain than magnesium sulfate.[19], [20]

Beyond magnesium supplementation given to expectant mothers and to newborns, there are certain interventions that can prevent some of the subsequent brain damage to low-birth-weight infants. One is specialized craniosacral

massage provided within hours or days of birth by licensed practitioners. Naturopaths can help identify food or airborne allergies that can worsen symptoms, and can recommend a wholesome diet and supplement program. Be warned that many supplements on the shelf contain aspartame, a potent neurotoxin. You should never expose your child to this chemical.

SUPPLEMENTS FOR CHILDREN WITH CEREBRAL PALSY

ReMag: (Picometer-ionic) 10 mg *kg* day or

Magnesium citrate: 10 mg *kg* day

ReLyte: Mineral-Electrolyte Solution: ¼ tsp twice a day

Vitamin B complex: 1 per day. Food-based, Grown by Nature

Vitamin C: 200 mg per day: 1 per day. Food-based, Grown by Nature

Bioflavonoids: 100 mg per day

Essential fatty acids: DHA, 1 tsp per day; cod liver oil, 1 tsp per day; flaxseed oil, 1 tsp per day

CHAPTER ELEVEN

OSTEOPOROSIS AND KIDNEY STONES

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM, OSTEOPOROSIS, AND KIDNEY STONES

1. Magnesium is just as important as calcium to prevent and treat osteoporosis.
2. Magnesium keeps calcium dissolved in the blood so it will not form kidney stones.
3. Taking calcium without magnesium for osteoporosis can promote kidney stones.

Muriel wondered how she managed to have soft bones and kidney stones all at the same time. Her recent bone density test showed obvious osteoporosis, yet she was now in the hospital with her third kidney stone attack. A young intern explained that she was losing calcium from her bones, which was being deposited in her kidneys and flushed out as hard, jagged crystals that were excruciatingly painful to pass. The high doses of calcium that she was taking for her

osteoporosis were only making matters worse.

Muriel's urologist did an analysis on her kidney stones and told her to stop eating all dairy products and to avoid calcium supplements, but Muriel was very concerned that her osteoporosis would worsen.

When she consulted with me, I was able to explain that there are approximately seventeen nutrients essential for healthy bones, including magnesium, the most important mineral along with calcium. Susan Brown, Ph.D., director of the Osteoporosis Education Project in Syracuse, New York, warns that "the use of calcium supplementation in the face of magnesium deficiency can lead to a deposition of calcium in the soft tissue such as the joints, promoting arthritis, or in the kidney, contributing to kidney stones."[1] Dr. Brown recommends a daily dose of only 450 mg of magnesium for the prevention and treatment of osteoporosis.

Women with osteoporosis have lower-than-average levels of magnesium in their diets, according to survey reports. Magnesium deficiency can compromise calcium metabolism and also hinder the body's production of vitamin D, further weakening bones.

Magnesium's role in bone health is multifaceted.

- Adequate levels of magnesium are essential for the absorption and metabolism of calcium.
- Magnesium stimulates a particular hormone, calcitonin, that helps to preserve bone structure and draws calcium out of the blood and soft tissues back into the bones, preventing some forms of arthritis and kidney

stones.

- Magnesium suppresses another bone hormone called parathyroid, preventing it from breaking down bone.
- Magnesium converts vitamin D into its active form so that it can help calcium absorption.
- Magnesium is required to activate an enzyme that is necessary to form new bone.
- Magnesium regulates active calcium transport.

With all these roles for magnesium to play, it is no wonder that even a mild deficiency can be a risk factor for osteoporosis. Further, if there is too much calcium in the body, especially from calcium supplementation, as in Muriel's case, magnesium absorption can be greatly impaired, resulting in worsening osteoporosis and the likelihood of kidney stones, arthritis, and heart disease. A chance meeting in a hotel with a woman whose lymphoma worsened immediately after being prescribed 2,500 mg of calcium, but no magnesium, for her osteoporosis made me consider that excess calcium can also deposit in cancerous tumors.

Other factors that are important in the development of osteoporosis include diet, drugs, endocrine imbalance, allergies, vitamin D deficiency, and lack of exercise. A detailed review of the osteoporosis literature shows that chronically low intake of magnesium, vitamin D, boron, and vitamins K, B_{12}, B_6, and folic acid leads to osteoporosis. Similarly, chronically high intake of protein, sodium chloride, alcohol, and caffeine adversely affects

bone health.[2], [3] The typical Western diet (high in protein, salt, and refined and processed foods) combined with an increasingly sedentary lifestyle contributes to the increasing incidence of osteoporosis.

Looking at her lifestyle, Muriel saw how much she had contributed to her own condition. She averaged five cups of coffee, three glasses of wine, and twenty cigarettes a day. This was causing calcium and magnesium, and the other nutrients that have to deal with toxins, to be overworked or flushed out of her body. Her diet was mostly nutrient-deficient fast food because she was constantly on the run. Muriel also drank lots of soda, which is high in sugar and phosphorus, both of which cause calcium and magnesium to be eliminated. She also avoided the sun and therefore got little vitamin D.

Instead of becoming discouraged, Muriel was able to look on the bright side. At least now she knew what lifestyle habits she had to change and what supplements to take. Her kidney stones soon became a thing of the past, her overall health dramatically improved, and after two years she had not just stopped losing bone but actually saw an increase in her bone density.

OSTEOPOROSIS MISUNDERSTOOD AND MISTREATED

Osteoporosis is neither a normal nor inevitable consequence of aging: Our bones were designed to last a lifetime. Popular wisdom, however, is that osteoporosis in women is due to a decrease in estrogen levels with age. Doctors therefore rely on estrogen, calcium, and drugs that stimulate bone formation to treat osteoporosis. The National Institutes of Health (NIH) Osteoporosis Prevention, Diagnosis, and Therapy Consensus Statement of 2000 was developed from a conference including eighty experts, but no mention of magnesium deficiency as a causative factor in osteoporosis was made in the final report.[4]

With drug companies funding most of the osteoporosis research, there are no large clinical trials investigating the magnesium connection in bone production. Although I was able to find over 22,000 journal articles on osteoporosis, there were only ten in the past decade that studied the magnesium connection in humans. As long as people are given false hope that there is some magic bullet in the pharmaceutical pipeline that will "cure" osteoporosis, or any other chronic disease, they will ignore the underlying diet-and nutrient-related reasons for their health problems.

The recent report that Fosamax causes jawbone deterioration is evidence that this drug, and likely all bisphosphonates, cause brittle bones. Fosamax destroys osteoclasts, the cells that remodel bone (sculpt the bone as new bone forms). Fosamax is therefore supposed to prevent bone breakdown—but the drug companies did not reckon with the bone-remodeling function of the osteoclast.

X-rays of bones under the influence of Fosamax may look like they have more calcium but without the remodeling capacity the bones' internal structure is in disarray, and bones are more brittle, and may actually break more easily.

When you read the scientific literature, there is ample evidence that many nutrients, especially magnesium, play a crucial role in bone development. Much animal research, for example, proves that magnesium depletion alters bone and mineral metabolism, which results in bone loss and osteoporosis.[5], [6] Magnesium deficiency is very common in women with osteoporosis compared to controls.[7]

In one study, postmenopausal women with osteoporosis were able to stop the progression of the disease with 250–750 mg of magnesium daily for two years. Without any other added measures, 8 percent of these women experienced a net increase in bone density.[8] A group of menopausal women given a magnesium hydroxide supplement for two years had fewer fractures and a significant increase in bone density.[9] Another study showed that by taking magnesium lactate (1,500–3,000 mg daily for two years), 65 percent of the women were completely free of pain and had no further degeneration of spinal vertebrae.[10] Magnesium in conjunction with hormonal replacement improved bone density in several groups of women compared to controls.[11], [12] In fact, if you are taking estrogen and have a low magnesium intake, calcium supplementation may increase your risk of thrombosis (blood clotting that can lead to a heart attack).[13]

It is unfortunate that the treatment for osteoporosis has

been simplified into the single battle cry "Take calcium." Calcium dominates every discussion about osteoporosis, is used to fortify dozens of foods (including orange juice and cereal), and is a top-selling supplement, but it cannot stand alone. In Chapter 1, we talked about the dance of calcium and magnesium. These minerals work so closely together that the lack of one immediately diminishes the effectiveness of the other. Even though the use of calcium supplementation for the management of osteoporosis has increased significantly in the last decade, scientific studies do not support such large doses after menopause[14] and soft tissue calcification is a serious side effect.

Osteoporosis is generally a progressive disease, and some say it is incurable, but if you avoid the risk factors that are under your control, take a good range of bone-building nutrients, and exercise, you can halt the condition even if you have the symptoms. Prevention is the best defense, the key elements of which are:

- Eat a balanced, nutrient-rich diet.
- Increase dietary calcium, take magnesium supplements, and bone support factors found in ReLyte and food-based B and C Complex.
- Practice some form of exercise every day.

DIET FOR OSTEOPOROSIS

A high-protein diet and excess sugar, alcohol, and coffee all rob the body of essential minerals. Prevention in the form of fruit and vegetables containing large amounts of calcium, magnesium, and potassium contributes to maintenance of bone mineral density.[15] Add more vegetables, whole grains, legumes, nuts, and seeds to your diet, and be sure to include some of the magnesium-rich foods listed on this page. The foods that are high in calcium are usually abundant in magnesium as well, including nuts and seeds, sardines, bok choy (Chinese cabbage), and broccoli. See the list of foods containing high amounts of calcium on this page.

SUPPLEMENTS FOR OSTEOPOROSIS

ReMag: (Picometer-ionic)150 mg 2–3 times a day and/or

Magnesium citrate: 300 mg twice a day

Calcium: dietary including bone broth, 700 mg

ReLyte: Mineral-Electrolyte Solution: The 12 minerals include several bone minerals: boron, copper, manganese, zinc: ½ tsp three times a day

Vitamin D, A, and K_2: From Blue Ice Royal (fermented cod liver oil and butter oil: 2 capsules per day)

Vitamin D: 20 minutes in the sun daily if possible

Vitamin B complex: 2 per day. Food-based, Grown by

Nature

Vitamin C: 1,000 mg per day

Progesterone for postmenopausal women under the advice of your doctor and after hormonal saliva testing to determine deficiency of progesterone: days 1–25, use ¼ tsp of progesterone cream, rubbed into the skin, twice a day; take a break days 25–31 (make sure the product contains USP progesterone). Test levels every three to six months to prevent progesterone excess.

You can only obtain about one-third of your mineral needs from good organic foods. The supplement doses above assume that you are already getting some minerals in your diet. If you do not eat a good diet, your mineral supplement amounts should be increased by 50 percent.

KIDNEY STONES

Kidney stones occur when the microscopic debris excreted in the urine becomes too concentrated to pass freely out of the kidneys into the bladder. Kidney stones are quite common in the general population. Risk factors for kidney stones include a history of hypertension, chronic dehydration, and a low dietary intake of magnesium.[16] One percent of autopsies reveal stones in the urinary tract, but most are small enough to pass unnoticed. Up to 15 percent of white men and 6 percent of all women will develop one stone, with recurrence in about half of these people. Approximately one person in a thousand in the United States is hospitalized annually with excruciatingly painful stones trapped in their urinary passages. The pain begins in the lower back and can radiate across the abdomen or into the genitals or the inside of the thigh.

Most kidney stones are made up of calcium phosphate, calcium oxalate, or uric acid. (The kind of stones you have can be determined from an analysis of passed stones.) Calcium stones are seen chiefly in men, often with a family history. Calcium phosphate and calcium oxalate alone are responsible for almost 85 percent of all stones. Uric acid stones make up 5–10 percent of all stones. They are also seen mostly in men, half of whom have gout. The remaining 5 percent are rare stones that can be formed during kidney infections.

Diagnosis is made by urinalysis and X-ray. If there are only a few calcium crystals or small stones, often no treatment may be needed, but pain may be relieved with painkillers and muscle relaxants. Larger stones are treated with surgery or with lithotripsy (the breakdown of the stones into little pieces using special ultrasound machines).

Several factors can be involved in stone formation:

1. Elevated calcium in the urine is caused by a diet high in sugar, fructose, alcohol, coffee, and meat. These acidic foods pull calcium from the bone and excrete it through the kidneys. Calcium supplementation without magnesium also causes elevated calcium in the urine.

2. Higher-than-normal levels of oxalate found in the urine may relate to a high dietary intake of oxalic-acid-containing foods: rhubarb, spinach, chard, raw parsley, chocolate, tea, and coffee, among others. The oxalic acid in them promotes stone formation by binding to calcium, creating insoluble calcium oxalate.

3. Dehydration concentrates calcium and other minerals in the urine. Six to eight glasses of water a day are essential to flush the kidneys properly. Increased sweating and not enough water intake create concentrated urine.

4. Soft drinks containing phosphoric acid encourage kidney stones in some people by pulling calcium out of the bones and depositing it in the kidneys.

5. A diet high in purines (substances found in

alcohol, meat, and fish) can cause uric acid kidney stones.

Kidney stones and magnesium deficiency share the same list of causes, including a diet high in sugar, alcohol, oxalates, and coffee. An important animal study shows that a high dietary intake of fructose (from high-fructose corn syrup, used as a sweetener) significantly increases kidney calcification, especially when dietary magnesium is low.[17] The U.S. Department of Agriculture warns that young people, especially, derive too many of their daily calories from the high-fructose corn syrup in sodas and eat few greens, which are rich in magnesium. The phosphoric acid in soft drinks is also punishing to the magnesium in the body and depletes magnesium stores while wearing away bone.[18], [19]

One of magnesium's many jobs is to keep calcium in solution to prevent it from solidifying into crystals; even at times of dehydration, if there is sufficient magnesium, calcium will stay in solution. Magnesium is the pivotal treatment for kidney stones. If you don't have enough magnesium to help dissolve calcium, you will end up with various forms of calcification. This translates into stones, muscle spasms, fibrositis, fibromyalgia, and atherosclerosis (calcification of the arteries).

Dr. George Bunce has clinically proven the relationship between kidney stones and magnesium deficiency.[20] As early as 1964, Bunce reported the benefits of administering a 420 mg dose of magnesium oxide per day to patients who had a history of frequent stone formation.

When there is more calcium than magnesium, kidney stones can form. Let's look at that simple experiment from Chapter 1 again to prove the point. Crush and stir a calcium tablet in 1 oz of water; note how much dissolves and how much is still swirling around in the bottom of the glass. Then add a crushed magnesium tablet, or the contents from a magnesium capsule, to the water and see how much more calcium dissolves. If calcium is dissolved properly in the blood, then it won't form crystals in the kidney.

Several older studies show the benefits of magnesium hydroxide in preventing stone formation. Fifty-five patients with a combined 480 stones in the previous ten years were placed on 200 mg of magnesium hydroxide daily. Patients were followed for two to four years, and only eight patients developed new stones. Of a group of forty-three kidney stone patients who did not receive magnesium, 59 percent developed new kidney stones over a four-year period.[21] An even earlier study using magnesium oxide and vitamin B_6 (a natural diuretic) showed a decrease in stone formation for 149 patients, who went from an average of 1.3 stones per year to 0.1 stones. Patients were followed for between four and a half and six years.[22] In another study, fifty-six patients were given 200 mg of magnesium hydroxide twice per day. At the two-year mark, forty-five were free of kidney stone recurrence; of thirty-four patients not taking magnesium, fifteen had recurrences after two years.[23]

Other studies show that urinary magnesium concentration is abnormally low and urinary calcium concentration is abnormally high in more than 25 percent

of patients with kidney stones. Supplemental magnesium intake corrects this abnormality and prevents the recurrence of stones. Other researchers acknowledge that magnesium oxide or magnesium hydroxide therapy causes a considerable lessening of kidney stone recurrence in men and feel that soft tissue calcifications can be stopped and even prevented by magnesium therapy.[24] Magnesium seems to be as effective against stone formation as diuretics, the major drug treatment for kidney stones.[25] Avoidance of calcium, taking diuretics, and mechanical intervention, however, seem to constitute the current allopathic medical approach to kidney stones.

More recent reports indicate that magnesium citrate may be a better choice than either magnesium oxide or magnesium hydroxide because it is better absorbed. Only 4 percent of magnesium oxide finds its way into body tissues. A 2005 review paper notes that while magnesium oxide and magnesium hydroxide had been looked upon favorably for the treatment of kidney stones, magnesium citrate proved to be far superior in double-blind, randomized, placebo-controlled trials, reducing the occurrence of kidney stones by 90 percent.[26]

Epidemiological findings round out the picture of kidney stone occurrence and its association with low magnesium intake. For example, the disease pattern in Greenland includes a low incidence of heart disease and kidney and urinary tract stones, few cases of diabetes mellitus, and little osteoporosis, all of which may be related to low calcium and high magnesium in Greenlanders' diet.[27]

DIETARY TREATMENT FOR KIDNEY STONES

On a regular basis, drink six to eight glasses of water (with a pH above 7.5) a day; increase intake of green vegetables and fiber (vegetarians have a 40–60 percent decreased risk of stone formation) and foods high in magnesium, such as seeds, vegetables, and whole grains; and decrease consumption of sugar, alcohol, coffee, and meat.

For uric acid kidney stones, decrease consumption of foods high in purine, such as alcohol, anchovies, herring, lentils, meat, mushrooms, organ meats, sardines, seafood, and shellfish. For oxalate stones, decrease consumption of foods high in oxalic acid: red beet tops, black tea, cocoa, cranberry, nuts, parsley, tomatoes, rhubarb, chard, and spinach. The citric acid in lemons, limes, oranges, pineapples, and gooseberries dissolves calcium oxalate and calcium phosphate, preventing stone formation.

SUPPLEMENTS FOR KIDNEY STONES

ReMag: (Picometer-ionic)150 mg 2–3 times a day and/or

Magnesium citrate: 300 mg twice per day

ReLyte: Mineral-Electrolyte Solution. The 12 minerals include potassium; ½ tsp three times a day

Vitamin B_6: 25mg twice daily

Vitamin B complex: 2 per day. Food-based, Grown by Nature

PART THREE

THE RESEARCH CONTINUES

While research identifying magnesium deficiency as a causative factor in heart disease, migraines, and eclampsia is clear-cut, many investigators believe that magnesium also plays an important role in chronic fatigue syndrome, fibromyalgia, environmental illness, and aging. More investigation needs to be done on these conditions to prove that magnesium deficiency is a contributing factor and that magnesium replacement should be part of the treatment protocol. Part Three offers a review of what many clinicians and researchers already know about these conditions and the magnesium connection.

But first, let's look at magnesium through the eyes of John I. Rodale, editor of *Prevention* magazine, who in 1968 wrote *Magnesium: The Nutrient That Could Change Your Life* (available free online at www.mgwater.com/rodtitle.shtml). Rodale unearthed scientific and clinical research on the use of magnesium in treating infection, polio, epilepsy, alcoholism, prostate inflammation, cancer, and arthritis. Unfortunately, much of

this research has been lost or ignored, but it deserves mention in order to stimulate further discussion and open doors to more investigation of the safety and effectiveness of magnesium.

The scientific research on magnesium that Rodale reported in his book highlighted the work of a brilliant French surgeon named Pierre Delbet. His interest in magnesium spread to many other doctors in France, who expanded his work. Rodale gives a long list of French physicians who over the years verified Dr. Delbet's findings and made new ones of their own. Delbet's magnesium research began while he was searching for a suitable antiseptic solution to apply to the wounds of soldiers injured in World War I and discovered that magnesium chloride had wonderful healing properties when applied externally.

IMMUNE SYSTEM

After judging magnesium chloride to be a very effective antiseptic solution, Dr. Delbet began testing oral forms of it on dogs and then with his patients, finding it to be a powerful immune system booster. In a paper presented to the French Academy of Medicine in September 1915, Delbet describes the effect on white blood cells of a solution of magnesium chloride injected into the veins of dogs. White blood cells from a blood sample taken before and after the injection were tested for their microbe-killing ability. Rodale reports that "five hundred white cells in the first sample destroyed 245 microbes. Five hundred white cells from the second destroyed 681. This increase in microbe-killing under the influence of magnesium chloride was 180 percent over the other solutions. More experiments were performed; in one there was an increase to 129 percent, in another, 333 percent."

POLIO

Fortunately, polio is not the scourge it once was. However, a follower of Dr. Delbet, Dr. Neveu, published a booklet titled *Therapeutic Treatment of Infectious Diseases by Magnesium Chloride: Poliomyelitis*. The book described fifteen cases of polio effectively treated with magnesium chloride. Neveu was so convinced of the effectiveness of magnesium chloride that he insisted that every home should have a solution of magnesium chloride on hand to treat the first signs of sore throat, especially when stiffness of the neck was involved. His formula was 20 grams of magnesium chloride powder to 1 liter of water.

SEIZURES

Rodale found evidence that seizures could be treated with magnesium. Dr. Lewis B. Barnett, head of the Hereford Clinic and Deaf Smith Research Foundation in Hereford, Texas, learned that magnesium is low in people with epilepsy. In the 1950s he presented evidence on thirty cases of childhood seizures that responded exceptionally well to high oral doses of magnesium. Barnett found that as his patients' blood magnesium reached normal levels, their seizure activity diminished. He also reported that the treatment was entirely harmless. As a result of his research, Barnett reported that the main cause for the 3 million clinical and 10–15 million subclinical cases of epilepsy identified at the time was a deficiency of magnesium.

CANCER

With one in two men and one in three women developing cancer in their lifetime, it's important to mention the relationship of this serious condition to magnesium deficiency. Dr. Mildred Seelig wrote a detailed paper on cancer and its interaction with minerals and vitamins with a focus on magnesium (available at www.mgwater.com/cancer.shtml). She noted a relationship between magnesium deficiency and cancer, which should have alerted the cancer establishment to do further research. J. I. Rodale wrote a chapter on cancer and magnesium in his 1963 publication with evidence from doctors in France of its importance.

Dr. Delbet felt that magnesium acts as a "brake" for cancer. He also observed that as the body grows older it grows more deficient in magnesium, and with this loss in magnesium there is a decrease in vitality, resistance, and cell regeneration.

PROSTATE

There appears to be no medical cure for swelling of the prostate (benign prostatic hypertrophy, or BPH) that leads to frequent nighttime urination. However, in 1930 Dr. Delbet and another doctor made two separate presentations to the Medical Academy of France showing that magnesium chloride could adequately treat this condition.

SENILITY AND AGING

It appears that the early French researchers were very aware of the problem caused by calcium precipitating into the tissues of the body. Dr. Delbet observed that with age, the body's tissues have three times more calcium than magnesium, and he concluded that magnesium deficiency plays a role in senility.

ALCOHOLISM

In his research, Delbet came to the conclusion that a major cause of alcoholism is magnesium deficiency. Unfortunately, there is little research being done on this association and even less on the clinical application of magnesium in the treatment of alcoholism in spite of the fact that medical researchers comment on alcoholism's association with magnesium deficiency.

MAGNESIUM AND BODY ODOR

There are no scientific studies about the effects of magnesium on body odor, but Rodale reported in his book that Delbet considered body odor to be due to an imbalance in the normal intestinal bacteria and that magnesium somehow restored that balance. Rodale later collected many anecdotal reports about the reduction of underarm odor, stool odor, and general body odor in people taking magnesium.

CHAPTER TWELVE

CHRONIC FATIGUE SYNDROME AND FIBROMYALGIA

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM, CHRONIC FATIGUE SYNDROME, AND FIBROMYALGIA

1. Magnesium deficiency is common in chronic fatigue syndrome and fibromyalgia sufferers.
2. Magnesium forms an important part of treatment for chronic fatigue syndrome and fibromyalgia.
3. Magnesium ameliorates the fatigue, muscle pain, and chemical sensitivity of chronic fatigue syndrome and fibromyalgia.

Over the past one hundred years, we have had a tremendous love affair with chemicals and electronics and a strange marriage with scientific methodology. It is safe to say that important advances in chemicals, pharmaceuticals, and science in general came out of the World War II effort and space research. The unseen potential risks to the public were presumably outweighed by the crisis of the time.

However, our sedentary lifestyle, consumption of synthetic foods, environmental chemicals, and polluted atmosphere have coincided with a greater frequency of chronic fatigue syndrome and fibromyalgia. On a parallel track, magnesium and other nutrients have become woefully depleted and, as we will see in Chapter 13, leave us unable to protect our bodies and brains from chemicals.

CHRONIC FATIGUE SYNDROME

Chronic fatigue syndrome (CFS) was formally recognized and defined as an illness by the Centers for Disease Control (CDC) in 1988. Before that time, and even since, many doctors considered the condition psychological. CFS goes by various names: Epstein-Barr, yuppie flu, and, in Britain, myalgic encephalomyelitis (which identifies the muscles and brain as sites of inflammation). Unfortunately, chronic fatigue syndrome is the name that has stuck in the United States, which makes it seem related to the generalized fatigue that anyone can suffer at one time or another. The name minimizes the global impact that this devastating disease can have on a person's life.

The symptoms of CFS are chronic headaches, swollen glands, periodic fevers and chills, muscle and joint aches and pains, muscle weakness, sore throat, and numbness and tingling of the extremities. The general feeling is one of incredible fatigue and inability to do even the simplest of tasks without becoming exhausted, inability to cope with any stress, and insomnia.

There are many theories about the cause of CFS, but one triggering factor could be a reactivation of an already present mononucleosis-like virus called Epstein-Barr virus. Upward of 90 percent of the population already has antibodies to Epstein-Barr virus, meaning the virus infected them at some point in their lives. In most people the infection came and went like a normal cold or flu. But for some, the first infection or the reactivation of the virus can be quite severe and leave them feeling fatigued, run-down, and never truly healthy again.

If CFS is some type of infection presenting itself in a new way, then the people it affects most severely seem to be more run-down and stressed than average. It appears that this infection becomes chronic because the immune system is not strong enough to fight it off or because sufferers come in contact with a chemical or pollutant that undermines their resistance and allows them to succumb to the illness. One of the ways the immune system is stressed is by the generalized depletion of minerals and vitamins that it needs to function properly.

CHRONIC FATIGUE SYNDROME DIAGNOSTIC CRITERIA

MAJOR CRITERIA

- New onset of fatigue, causing a 50 percent reduction in activity for at least six months
- Exclusion of other illnesses that can cause fatigue

MINOR CRITERIA

- Presence of eight of eleven symptoms, or six of eleven symptoms and two of the three signs

Symptoms

- Mild fever
- Recurrent sore throat
- Painful lymph nodes
- Muscle weakness
- Muscle pain
- Prolonged fatigue after exercise
- Recurrent headache
- Migratory joint pain
- Neurological or psychological complaints: sensitivity to bright light, forgetfulness, confusion, inability to concentrate, excessive irritability, depression
- Sleep disturbance
- Sudden onset of symptom complex

Signs

- Low-grade fever
- Sore throat without signs of pus
- Palpable or tender lymph nodes

Sheila fit the profile of chronic fatigue syndrome. After suffering mononucleosis during college, she has never felt quite the same. The mono seemed to weaken her immune

system and her adrenal glands. Sheila worked as a teacher and was constantly exposed to germs, coming down with every cold and flu that passed through the school. Because she traveled a lot, she received numerous inoculations, which further weakened her. In her spare time she enjoyed furniture refinishing, which exposed her to tung oil, found in varnishes, paint strippers, and paint. Tung oil is made from euphorbia, a plant that produces phorbol esters, and has been proposed as a causative agent for chronic fatigue syndrome.[1]

After a trip to the Far East, Sheila became more and more fatigued and came down with a terrible month-long flu with a horribly achy head, muscles, and joints. Her doctor put her on one antibiotic after another, even though she had no bacterial infection. Her cough and chest pain finally cleared up, but she continued to have periodic fevers, a sore throat, and sore muscles. She couldn't exercise at all because she would end up in bed for days, and no matter how tired she was, she couldn't sleep. Sheila was depressed by this constant sickness. Sometimes she felt as if she were losing her mind: she couldn't concentrate, remember, or perform simple arithmetic. She couldn't teach and was so exhausted that she could do only the bare minimum to take care of herself.

Fortunately, Sheila's doctor was involved with a study at a local university looking into possible drug treatments for CFS. Sheila entered the blind study and did not know which treatment she was receiving. The three medications were an antiinflammatory drug (ibuprofen), an antidepressant (amitriptyline), and magnesium glycinate.

She had weekly visits with a nurse to assess her symptoms, twenty-four-hour urine collections, blood tests, and questionnaires. After two weeks her fatigue improved, as did her muscle weakness, twitching, poor concentration, and irritability.

At the end of the study, Sheila was told that her treatment had been 300 mg of elemental magnesium twice a day, that her magnesium had been very low at the beginning of the study, and that she could safely continue with the treatment if she wished. Sheila now had the energy to do more things to take care of herself: exercise, shop for the right foods, and prepare more meals from fresh foods. She knew she was on the road to recovery, thanks to magnesium. Several other studies confirm the efficacy of using magnesium for the treatment of chronic fatigue syndrome symptoms.[2], [3], [4], [5]

FIBROMYALGIA DIAGNOSTIC CRITERIA

MAJOR CRITERIA

- Generalized aches or stiffness of at least three anatomical sites for at least three months
- Six or more typical, reproducible tender points, called trigger points, in the muscles
- Exclusion of other disorders that can cause similar symptoms

MINOR CRITERIA

- Generalized fatigue
- Chronic headaches
- Sleep disturbances
- Neurological and psychological complaints
- Joint swelling
- Numbness or tingling sensation
- Irritable bowel syndrome
- Variation of symptoms in relation to activity, stress, and weather changes

FIBROMYALGIA

It wasn't until 1990 that the American College of Rheumatology established diagnostic criteria for fibromyalgia, thereby giving it official status as an illness. *Fibro* means "connective tissue" and refers to the thin tissue that wraps around muscles, and *myalgia* means "muscle pain." Also called fibrositis, fibromyalgia is a close cousin of CFS and shares many of its symptoms: incapacitating fatigue, muscle and joint pain, neuralgia, sleep disorders, anxiety, depression, cognitive confusion, and digestive problems. (CFS sufferers, in addition, have mild fever, swollen glands, and a sore throat, which distinguishes them from fibromyalgia patients.) Having a name, however, does not define the causes of the illness, and the American College of Rheumatology does not offer a curative treatment.

I believe fibromyalgia is the latest label for an accumulation of toxins and infections from both environment and lifestyle. Twenty-six doctors who present their cases in a book on chronic fatigue and fibromyalgia agree.[6]

Our exposure to toxins, chemicals, and prescription drugs begins at birth. Substances we think are safe can break down our immune systems and deplete our nutrient reserves. I and many other doctors believe they lead to CFS, fibromyalgia, and environmental illness in a growing list of sufferers.[7] Here's a chronology of ailments and the kinds of treatments any one of us may receive over the course of a lifetime. Each treatment can trigger the next event and further drug intervention. However, in my

experience, a person with fibromyalgia can diminish his or her symptoms by 50 percent by taking the right amount of magnesium. In order to get sufficient magnesium into the tissues of the body that may mean taking IV magnesium, or more conveniently, applying magnesium oil or gel on the body. See Chapter 18 for detailed information.

POSSIBLE HEALTH CHRONOLOGY FOR CFS AND FIBROMYALGIA SUFFERERS

- Diaper rash, caused by *Candida albicans* (yeast), is mistakenly treated with cortisone creams, which encourage further growth of the yeast.
- Childhood ear infections can begin at birth as yeast infections picked up from the mother during delivery. Most ear infections are treated with antibiotics.
- Ear infections may become chronic and require multiple courses of antibiotics, leading to diarrhea and intestinal yeast infections.
- Anesthetics used in surgery to place tubes in the ears add another toxin.
- Colic can develop due to antibiotics.
- Inability to digest milk due to an irritated bowel leads to frequent changes of formula and further irritation.
- Gas and bloating can result from hard-to-digest soy formula.
- Eczema, aggravated by food sensitivity, is suppressed with cortisone creams.
- Allergies to foods, especially yeast, wheat, and dairy, can arise from poor digestion.
- Asthma, which may be environmental, is treated with medications including corticosteroid inhalers.
- Multiple colds and flus are mistreated with many courses of antibiotics.
- Annual flu vaccines contain mercury preservative.

- Cravings for sweets can be caused by yeast overgrowth and may cause or aggravate hyperactive behavior in children.
- Dental cavities lead to multiple mercury amalgam fillings. Toxic mercury vapor may be inhaled or absorbed, disrupting enzymes in the brain, kidneys, and liver.
- Allergic reactions are treated with allergy shots, antihistamines, and cortisone sprays.
- Many adolescents take long-term oral antibiotics for acne.
- Many teens and young adults develop mononucleosis, and up to 20 percent never feel quite as healthy again.
- Bladder infections are treated with antibiotics, which cause yeast infections.
- Birth control pills cause chronic vaginal yeast infections, which are mistreated with antibiotic creams.
- Pregnancy hormones encourage vaginal yeast infections.
- Chronic sleep deprivation is common in all parents of small children and is a major stress on the immune system.
- Irritable bowel syndrome can develop after a bout of diarrhea (attributed to traveler's diarrhea or food poisoning) and is usually treated with antibiotics.
- Chronic sinus infections (97 percent are fungal, according to the Mayo Clinic) occur due to lowered

immune system and are mistakenly treated with antibiotics.

- Hypothyroidism often occurs but remains undiagnosed and untreated.
- Hospitalization for infections or surgery usually warrants intravenous antibiotics and a host of other drugs.
- Major colds and flus can lead to bronchitis and pneumonia, which are treated with strong antibiotics.
- Chronic fatigue syndrome and fibromyalgia are treated with antiinflammatories, sleeping pills, and antidepressants.
- Environmental allergies with extreme sensitivities to inhalants, especially perfumes, colognes, household products, pesticides, and molds, are treated with corticosteroid inhalers.
- Dysmenorrhea, irregular periods, infertility, and worsening premenstrual symptoms occur due to a buildup of toxins and lack of nutrients.
- Infertility is treated with an array of synthetic hormonal drugs.
- Depression, anxiety, panic attacks, and palpitations are treated with antidepressants and psychotherapy.
- Menopause is medicated with synthetic hormones.

Magnesium is depleted with every step of this scenario and results in a total body burden of drugs, toxins, and various stressors. The end result looks very much like chronic

fatigue syndrome.

Let's look at the journey through life from the ground up to understand why we have become so nutrient-deficient and how this affects the immune system.

Plants grown on devitalized, overworked soil that has been poisoned by acid rain are poor in nutrients, including magnesium. The topic of magnesium-deficient soil is covered in Chapter 2. Synthetic foods created by modern processing and refining are devoid of natural vitamins, minerals, and fiber. They are "fortified" with useless synthetic vitamins and often no minerals except calcium or iron. Magnesium is the nutrient hardest hit by food processing.

The body is not able to adequately process junk food, with its dozens of chemical additives. It treats these chemical additives like foreign invaders and has to detoxify them in the liver. The intermediary metabolites are sometimes more toxic than the original, leaving the body hypersensitive and hyperimmune, sometimes turning on the body and creating autoimmune disease (such as multiple sclerosis or rheumatoid arthritis). Magnesium is depleted in the attempt to detoxify the body of these foreign chemicals.

There are thousands of medicinal drugs currently in use. Magnesium expert Dr. Mildred Seelig tells us that the side effects of many drugs may be associated with magnesium deficiency because magnesium becomes depleted while the body is trying to detoxify these drugs.

With the advent of antibiotics and the hope that they could cure all our infectious diseases, there is an overuse of

these powerful drugs. When antibiotics kill bacteria, they cannot discriminate; they kill both good and bad bacteria. The good bacteria killed in the gastrointestinal tract are then replaced with yeast (*Candida albicans*).

The birth control pill, with its daily hormone surge, feeds yeast in the gut, as do sugar products. Yeast overgrowth results in episodes of alternating diarrhea and constipation. Magnesium is lost due to diarrhea and is drained by the constant demand to balance the pH of the body due to the acidity of soda pop and junk food.

The symptoms from yeast and its breakdown products are bodywide. Often these symptoms lead one to think that there are infections in the sinuses, throat, bladder, or vagina. A doctor will consequently prescribe more antibiotics for these symptoms, which merely perpetuates the problem. Overgrowth of yeast in the intestines can cause micropunctures in their lining, called *leaky gut*, thus allowing the absorption of incompletely digested food into the bloodstream. These undigested food particles are now foreign bodies, and the immune system reacts by forming antibodies to try to get rid of them. Food allergies and sensitivities result.

Allergies are created when inhaled chemicals and toxins irritate the mucous membranes of the nasal passages. They can trigger symptoms of asthma, which is made worse by magnesium deficiency.

Depression can be a direct result of accumulating chemicals in the body from drugs, synthetic food, and infections. When the brain is deficient in magnesium it is no longer protected from the onslaught of chemicals such

as aspartame and MSG.

Because there are no medical tests to confirm that chemicals, drugs, and synthetic food are causing our symptoms, people who feel sick are often told that "everything is normal." This is frustrating and depressing, which makes sufferers feel even more unwell. The majority of chronically ill patients who come to my office or consult me by phone have seen between six and thirty doctors in one year for their complaints. Patients with fatigue or depression have usually been referred to a psychiatrist. Some patients have been prescribed thousands of dollars' worth of drugs annually to treat their multiple complaints, which usually have done no good and merely added to their toxin load.

The complex nature of CFS and fibromyalgia is formidable. Even though more doctors understand and accept the existence of CFS, the focus of CFS research seems to be on finding one cause. And the treatments offered are only symptomatic: rheumatologists and psychiatrists treat sleeplessness with sleeping pills; pain with antiinflammatory drugs, painkillers, and muscle relaxants; and anxiety and depression with antianxiety drugs and antidepressants. No attention is paid to diet or nutrient deficiencies. They ignore the possibility that there could be a nutrient imbalance, such as a magnesium deficiency, or coexisting conditions, such as a yeast infection, low thyroid, or allergies, that cause a complex of symptoms. They also tend to overlook possible toxicities, which allow common infections to appear more virulent as they take advantage of a weakened host. Yet magnesium

deficiency is known to exacerbate all the symptoms of CFS and fibromyalgia, and increased magnesium intake has been effective in helping to restore health to many sufferers. Magnesium is also one of the best ways to strengthen the immune system and boost resistance against germs.

Exercise is often suggested for people suffering from fatigue, but even the mildest aerobic exercise is exhausting to people with CFS or fibromyalgia, who have no energy because their magnesium-driven energy system is bankrupt. Exercise also causes lactic acid buildup, which leads to more pain when it is not cleared by a particular enzyme that requires magnesium. Even the work of metabolizing pain medications depletes magnesium. This explains why chronic fatigue patients do not do well on most medications.

A buildup of lactic acid in the muscles causes pain and can be treated with 300 mg of elemental magnesium twice a day. If the joints accumulate toxicity, arthritis can occur; if the nerves are irritated by neurotoxins, they begin to lose their myelin sheath, and MS can result. In fact, autoimmune disease may also be the end stage of a buildup of toxicity along with a deficiency of nutrients, such as magnesium, that are designed to clear toxins from the body. According to some doctors, the definition of autoimmune disease as "disease against self" is not accurate; the disease process is, in fact, attacking a self altered by toxins and nutrient deficiencies.

Patients with fibromyalgia also have chronically low levels of serotonin, which greatly exaggerates their pain.

As mentioned previously, magnesium is a necessary building block for both the production and uptake of serotonin by brain cells.

STRESS

Acute episodes of CFS and fibromyalgia are often brought on by exposure to stress, whether emotional or physical. The consequent increase in adrenaline and stress chemicals hastens magnesium loss and can be a factor in both these conditions. Low levels of magnesium intensify the secretion of the stress chemicals, thus increasing the risk of adverse effects of stress and creating another vicious circle.[8]

FATIGUE

The overproduction of adrenaline due to stress leads to magnesium deficiency and therefore puts a strain on the magnesium-dependent energy system of the body, causing energy depletion that leads to fatigue. Fatigue is often reduced with magnesium supplementation. In fact, a major breakthrough occurred in CFS research when low magnesium levels were discovered in most sufferers. Of the many enzyme systems that require magnesium, the most important ones are responsible for energy production and storage.

Magnesium and malic acid, an acid found in apples, are both crucial to the body's energy production and useful in the treatment of CFS and fibromyalgia. In the case of fibromyalgia, low magnesium keeps muscles in a state of spasm, so supplementation can aid in relieving this painful symptom. A study by Guy D. Abraham, M.D., showed positive results in the reversal of fibromyalgia with magnesium and malic acid supplementation. Fifteen patients with fibromyalgia who took magnesium (300–600 mg) and malic acid (1,200–2,400 mg) experienced improvement in their symptoms within the first forty-eight hours. Over an eight-week period of supplementation their degree of muscle tenderness and pain dropped from 19.6 points to 6.5 points, according to standardized medical scores.[9]

TREATMENT FOR CHRONIC FATIGUE AND FIBROMYALGIA

The treatment for CFS and fibromyalgia should address yeast overgrowth and IBS. Read *The Yeast Connection and Women's Health* (Crook and Dean, 2005) and *IBS for Dummies* (Dean and Wheeler, 2005). Diet and supplements should focus on building the immune system and the digestive system. Supplements touted for these conditions are many and varied but should be individualized with the help of a caring and knowledgeable practitioner. Oral magnesium supplements and magnesium oil should form the cornerstone of therapy. Magnesium oil has the ability to increase the body's production of DHEA, a hormone that has beneficial effects on memory, stress, sleep, and depression, and naturally enhancing its effects will be very helpful for CFS and fibromyalgia. In my experience, using magnesium and treating yeast overgrowth can result in overall improvement of CFS and fibromyalgia of about 70–80 percent. Further improvement comes from treating low thyroid, estrogen dominance, and heavy metal toxicity with a picometer mineral combination called ReLyte.

CHAPTER THIRTEEN

ENVIRONMENTAL ILLNESS

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM AND ENVIRONMENTAL ILLNESS

1. Symptoms of chemical sensitivity can be completely or partially produced by magnesium deficiency.
2. Magnesium helps detoxify toxic chemicals.
3. Magnesium binds with and helps eliminate heavy metals from the body.

Dr. Sherry Rogers is a diplomate in family practice, allergy-asthma-immunology, and environmental medicine and a fellow of the American College of Nutrition. In private practice for more than thirty years, she treats very ill people from all over the world who have environmental toxicity and chemical sensitivity. The condition is called multiple chemical sensitivity (MCS) because a susceptible person usually has sensitivities to more than one chemical.

One of Dr. Rogers's basic maxims is that symptoms of

chemical sensitivity can be wholly or in part produced by magnesium deficiency. She has tested enough people over the decades to know this to be a fact, and part of her success derives from implementing magnesium therapy for all her patients. Dr. Rogers notes that Dr. Frederica P. Perera, professor of environmental health sciences and director of the Columbia Center for Children's Environmental Health, has indicated that there is as much as a 500-fold difference in the ability of individuals to detoxify the same chemical. One of the key markers of this difference is each individual's magnesium level.

CFS and fibromyalgia are actually aspects of environmental illness. In Chapter 12 we saw how these conditions develop over time in a toxic environment. Now we will take a closer look at some environmentally sensitive people and the chemicals they encountered.

Natalie, sometimes in jest but more often in anger, would call what she experienced a "chemical warfare attack." It happened when she stepped out onto her driveway and was enveloped by a cloud of chemical spray from a lawn care truck treating her neighbor's yard. She could neither breathe nor speak. Her lungs were on fire, and her head felt as though it were exploding. She felt dizzy and shaky. She managed to stagger into the house, where she collapsed on the floor. Her husband found her a few minutes later and took her to the hospital, where they could do very little except give her oxygen and tell her to rest.

Natalie had been the picture of health—athletic, active, and happy. Now she was chronically fatigued. She became hypersensitive to every chemical she came in contact with.

She couldn't even read; magazines and newspapers reeked of ink. Perfume samples that came in magazines were a nightmare. She had to find natural substitutes for cleaning products and cosmetics. Plants with moldy-smelling dirt had to go. She became allergic to wool. Her husband had to do all the cooking because she was sensitive to the gas fumes from their stove. Her diet became increasingly limited, as she reacted to many foods. When she couldn't even use the telephone because holding the plastic receiver gave her hives, she became a prisoner in her own home with no contact with the outside world.

Elizabeth, Ted, and their children developed an array of symptoms after they used urea formaldehyde insulation in their home renovation. As soon as it was installed, they noticed an odor. The contractor said not to worry, it would be gone in a few days. The only thing that was gone in a few days was the contractor. They phoned and phoned, but he never returned their calls. By the end of the week the whole family had what appeared to be a bad cold, their eyes and noses streaming. The children developed skin rashes, and they all were irritable, headachy, and tired. When the "cold" didn't go away in ten days they went to the doctor, who saw their red, irritated skin and mucous membranes but no signs of infection, except for swollen neck glands. The doctor suggested they might be allergic to something. That clinched it; they knew it was the insulation. They didn't know what they could do about it. They tried toughing it out to see if the chemical would dissipate, but when the central heating came on the next month the problem actually got worse. They were

beginning to be allergic to more and more things, and none of them felt well at all. Finally, they decided to rip out all the insulation, no matter what it cost.

Natalie, Elizabeth, Ted, and the children eventually got better. With much time, effort, and money and the help of sympathetic and knowledgeable health practitioners who understand the effects of the environment and the need to detoxify and nourish the body, they regained their health. The modalities they used were pure alkaline water, fresh air, organic foods, rotation diets, sauna therapy, vitamin and mineral supplements (especially 300 mg of elemental magnesium twice a day), homeopathy, acupuncture, and a positive attitude.

Some people with the above conditions are not as fortunate as Natalie, Elizabeth, and Ted, who at least knew what was harming them almost from the start. Those who gradually build up allergies and sensitivities to environmental toxins never know they're getting sick until they've developed asthma, eczema, or even cancer. What follows is an overview of our chemical environment and how its impact on our health can be lessened by neuroprotectants like magnesium.

In an important environmental study, toxic chemicals were found in nearly all foods tested by the FDA at levels consistent with negative health effects. They included persistent organic pollutants such as DDT and dioxin, which have been banned in the United States for decades but are still produced in other countries. Exposure to minuscule levels of these chemicals at crucial times in fetal and infant development can disrupt or damage human

hormone, reproductive, neurological, and immune systems.[1]

In 2000 the Centers for Disease Control released the very first large-scale national survey of environmental toxins from human samples, and the results are startling. Blood and urine levels of twenty-seven chemicals tested in 5,000 Americans far exceeded safe levels. The EPA and CDC mostly rely on air, water, and soil samples to test for toxic levels of chemicals. Even then, only a few dozen of the more than 100,000 chemicals in everyday use are monitored for safety.[2] Hopefully this human study will reinforce a cutback in chemical pesticide use, as pledged by the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA) in 1993. Chemical pesticide use, however, has increased from 900 million pounds in 1992 to 940 million pounds in 2000, while total cropland has decreased. And the riskiest chemical pesticides, such as organophosphates and carbamates, probable or possible carcinogens, still account for over 40 percent of the pesticides used in U.S. agriculture.[3]

The average American household generates fifteen pounds of household hazardous waste each year, according to the Texas Natural Resource Conservation Commission. “Our homes contain an average of three to eight gallons of hazardous materials in kitchens, bathrooms, garages and basements,” the government agency reports. And what is the consequence of all these chemicals in our home environment? In a California study the number of people with sensitivities to one or more common chemicals is “surprisingly large,” according to researchers. Just over 6

percent of the subjects reported having a diagnosis of multiple chemical sensitivity or environmental illness, and nearly 16 percent reported being allergic or unusually sensitive to everyday chemicals.[4]

In 1989, the World Health Organization took a strong stand regarding the origins of cancer when it stated that up to 80 percent of cancers are environmentally influenced. In 1985, the U.S. Environmental Protection Agency published a survey of human fat composition. It found that more than 99 percent of the population had measurable levels of the nine chemicals they tested for, including PCBs and DDT. In 2000, 100 percent of fat samples tested were positive for chemicals. Dr. Samuel Epstein, professor of occupational and environmental medicine at the University of Illinois Medical Center, Chicago, is an internationally recognized authority on the toxic and carcinogenic effects of environmental pollutants in air, water, and the workplace. His research was key to banning DDT and other problematic ingredients and contaminants in consumer products—food, cosmetics, and household products. In his keynote address to a Health Canada–sponsored cancer conference, he reported that we all now carry more than 500 different chemical compounds in our cells, none of which existed before 1920, and that "there is no safe dose for any of them."[5] With this information, activists have been demanding more use of safe alternatives to chemicals. But government and industry are still not listening.

Chemicals can destroy or paralyze different enzymes that protect us from external toxins. Thus, being exposed to chemicals prevents the body from protecting us from those

very chemicals. Magnesium is active in 700–800 enzyme systems in the body, and when its enzymes are paralyzed, it is unable to do its essential work of energy production, detoxification, and brain and nerve protection.

METALS AND MAGNESIUM

Dr. Deborah Baker has researched the health effects of mercury for over a decade.[6] She acknowledges that mercury pervades our environment through industrial exposure, but the major source of elemental mercury in the general North American population is mercury vapor released from dental amalgams.[7], [8], [9], [10] These amalgams are, on average, 50 percent mercury, and they offgas, or vaporize, into your body's cells every time you chew, brush your teeth, or eat anything hot or acidic. There is a significant positive correlation between the number of amalgams in the mouth and the mercury content of human tissues, including the brain.[11]

Mercury drastically increases the excretion of magnesium and calcium from the kidneys, which may be the cause of the kidney damage seen in mercury poisoning.[12] Such mineral loss impairs cell production, the storage and utilization of energy, and cellular repair and replication. Sufficient magnesium supplementation can not only undo some of this damage but can prevent certain types of heavy metal toxicity.[13], [14]

Long-term fetal exposure during pregnancy to even low concentrations of mercury can lead to irreversible developmental disorders.[15] The concentration of magnesium in the placental and fetal tissues necessarily increases during pregnancy.[16] Unfortunately, the demand for magnesium usually exceeds its supply, and thus anything that further lowers magnesium levels, such as mercury, puts the pregnancy and child at risk.

Dr. Baker says that approximately 85 percent of her patients, as part of their mercury detoxification protocol, supplement with 300 mg to 500 mg daily of magnesium glycinate, in divided doses. Her patients frequently comment that their muscular pain improves while on magnesium.

Lead and cadmium have a cumulative toxic effect on the kidney and heart in particular. Magnesium appears to be a competitive inhibitor of these two polluting metals at different sites, particularly during combined intoxication.[17] A Yugoslavian research team found that increased intake of magnesium eliminates lead via the urine and may do the same with certain other heavy metals. Under experimental conditions, they found that magnesium increased excretion of cadmium via the urine.[18] Adequate magnesium levels can also help prevent the toxic effects of aluminum, which include breakdown of sugar stores and disruption in the production of ATP energy.[19] However, if magnesium levels are low, these heavy metals will stay in the body, binding to tissues in the kidney and heart and (in the case of aluminum especially) crossing the blood-brain barrier and destroying brain cells.

TREATMENT

The hallmark of a mineral-deficient person is often one who takes vitamins without minerals and feels worse or does well for a while but then deteriorates.[20] If you have a mineral deficiency, especially of magnesium, which is necessary for energy production, certain areas of the body may be overstimulated by vitamin supplements, while other areas can't respond. Therefore, if you suffer severe environmental illness, it is important to have a health care practitioner monitor supplement intake and to begin with magnesium as one of your first supplements.

The treatment for environmental illness is individualized. Since allopathic medicine does not recognize environmental disease, it has not established treatment protocols. According to environmental experts, magnesium is essential to build up the body's energy and fully utilize its detoxification systems. The source of environmental toxins, however, must be eliminated or avoided; otherwise it is like bailing out a sinking ship by hand. You first have to be aware of the chemicals in your environment, avoid them like the plague, and work diligently with the following therapies to clean out your body.

The lowly dry-cleaning chemicals, the mercury in dental fillings, and the cleaning products under the kitchen sink all build up in our bodies and cause chronic disease. Air purifying machines, water filters, organic food, organic supplements, and natural alternatives to chemicals provide the foundation of environmental health therapies.

DIET

The key in treating environmental illness is to eat organic, free-range, unprocessed, unadulterated foods. The pesticides added to the soil and the antibiotics used on poultry and beef sicken the animals and the people who eat them. The rash of diseases in cattle is likely related to the low quality of their feed, the tons of drugs they are given to fatten them up, and the gallons of chemicals sprayed on them to treat parasites. Unfortunately, even organic farms are subjected to acid rain, contaminated groundwater, and polluted air, which means that all of us should take an active role in detoxifying our bodies of suspected chemicals.

Drink one-half your body weight in ounces of water daily. Chemicals in our environment that are water-soluble are eliminated through the kidneys and colon, especially if you drink enough pure water. Use a water filter that has a pore size of less than 0.5 microns and guarantees the elimination of chemicals as well as parasites.

To eliminate fat-soluble chemicals such as pesticides and herbicides, which can become even more toxic when they are broken down by the liver, you need dry or far-infrared saunas. Fasting is not recommended to eliminate toxins. Fat-soluble chemicals are stored in fat cells, which keeps them out of circulation. When you try to fast or diet, your fat stores are broken down for energy, and out come the chemicals. The headache, nausea, light-headedness, and irritability are not just from lack of food but also from poisons flooding your bloodstream. While fasting, I've tasted and felt the numbing effect of dental anesthetics from

decades before. If you are already feeling ill, fasting and dieting are going to be very unpleasant experiences.

DRY SAUNA

Numerous cultures use sweat lodges, steam baths, or saunas for cleansing and purification. Many health clubs and big apartment buildings have saunas and steam baths, and more and more people are building saunas in their own homes. Low-to-moderate-temperature saunas are one of the most important ways to detoxify from pesticide exposure. Head-to-toe perspiration through the skin, the largest organ of elimination, releases stored toxins and opens the pores. Fat that is close to the skin is heated, mobilized, and broken down, releasing toxins and breaking up cellulite. The heat increases metabolism, burns off calories, and gives the heart and circulation a workout. This is a boon if you don't have the energy to exercise. It is well known in medicine that a fever is the body's way of burning off an infection and stimulating the immune system. Fever therapy and sauna therapy are employed at alternative medicine healing centers to do just that. The controlled temperature in a sauna is excellent for relaxing muscular aches and pains and relieving sinus congestion. The only way I made it through my medical internship was by having regular saunas to reduce the daily stress.

FAR-INFRARED (FIR) SAUNAS

FIR saunas are inexpensive, convenient, and highly effective. Detox expert Dr. Sherry Rogers says that FIR is a proven and efficacious way of eliminating stored environmental toxins, and she thinks everyone should use one. There are one-person Sauna Domes that you lie under or more elaborate sauna boxes that seat several people. The far infrared provides a heat that increases the body temperature but the surrounding air is not overly heated. One advantage of the dome is that your head remains outside, which most people find more comfortable and less confining. Sweating begins within minutes of entering the dome and can be continued for thirty to sixty minutes. Besides the hundreds of toxins that can be removed through simple sweating, the heat of saunas creates a mild shock to the body, which researchers feel acts as a stimulus for the body's cells to become more efficient.

The outward signs are the production of sweat to help decrease the body temperature, but there is much more going on. Further research on sauna therapy is destined to make it an important medical therapy.

SUPPLEMENTS

If you have environmental illness, you feel as though you are sensitive or allergic to everything. When it comes to taking supplements, you may be unable to tolerate anything, but you might be deficient in everything. This does not necessarily mean that you are allergic to a particular supplement; rather, when you take it, your body responds by increasing some metabolic processes, which results in the body throwing off waste products that make you feel nauseated or headachy. That is why an organic diet, saunas, and exercise should be implemented before taking supplements.

The first supplement to add is magnesium. To make it a very safe and gradual process you can take Epsom salts baths, or use transdermal magnesium oil or picometer magnesium (in a spray bottle), to prevent the laxative effect. Later, you can begin 75 mg of picometer magnesium or 100 mg of elemental magnesium (magnesium taurate or magnesium glycinate) increasing every three days. If magnesium taurate and glycinate cause loose stools, just take picometer magnesium. “Green drinks” are the next food supplement to add. They are made from a variety of organic land and sea vegetables, and the better ones are flavored with stevia or nothing at all. Some green drinks are made with whey, hemp, or pea protein and make a good cleansing drink or meal replacement.

By now you should be feeling much better and able to add some more supplements under the guidance of a knowledgeable practitioner to help boost your immune system and provide necessary building blocks for health.

Environmental illness does not require high-dose supplementation like other diseases. In fact, since most megavitamins and minerals are derived synthetically, it is a far better approach to use low-potency food-based supplements from organic sources.

CHAPTER FOURTEEN

ASTHMA

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM AND ASTHMA

1. Research shows that many patients with asthma and other bronchial diseases have low magnesium.
2. Many drugs used in the treatment of asthma cause a loss of magnesium, only making symptoms worse.
3. Patients treated with simple magnesium supplementation report marked improvement in their symptoms.

As a child, Gerry had eczema. Every possible skin cream and lotion was tried, to no avail, but finally, after many years, the last patch disappeared on its own. It was followed almost immediately, however, by his first asthma attack. In his early thirties, Gerry was suffering attacks of wheezing and coughing when he exercised and when he was around cats, dogs, horses, dust, flowers, and chemical

smells. Various inhalers helped initially, but after a year or two they would stop working. He wasn't satisfied with them, anyway; one gave him heart palpitations, and another contained steroids, which made him gain weight and retain fluid. Then one day a vitamin newsletter came in the mail. He almost threw it out, but a headline caught his attention: MAGNESIUM HALTS ASTHMA SPASMS.

Asthma is characterized by bronchial spasm, swelling of the mucous membranes of the lung, excessive mucus production, and an inability to fully empty the lungs of air. Asthma finds its easiest victims in children under ten and is twice as common in boys and men, although it affects about 3 percent of the general population. Tabulating all the triggers of an asthma attack is a daunting task; there seems to be a variety of stimuli, including lung infection, exercise, emotional upset, food sensitivities, inhalation of cold air or irritating aromatic substances (smoke, gas fumes, paint fumes, chemical fumes), and reactions to specific allergens, such as pollens.

Bronchial spasms occur in both extrinsic asthma (an allergic reaction to external substances such as mold, dust, animal hair, pollens, and chemicals) and intrinsic asthma (from exercise, infection, and emotional upset). The allergic triggers, called allergens, initiate the release of histamines in your body, which try to eliminate the allergens by stimulating lots of mucus to mop up the allergens and push them out through sneezing, coughing, and watery eyes. One of the side effects of too much histamine is tightening of the bronchial tubes, which go into spasm. Such spasms can initiate episodic wheezing,

coughing, and shortness of breath, which quickly lead to rapid breathing, difficulty exhaling, anxiety, and dehydration. The anxiety of an asthma attack can create a gripping fear that tenses up the whole body and is hard to shake off.

Gerry really identified with what he read about asthma and magnesium in the newsletter. He realized that his whole body was tense. He decided to try some magnesium supplements under his doctor's supervision, and with them he was able to greatly decrease his medications.

Magnesium is an excellent treatment for asthma because it is a bronchodilator and an antihistamine, naturally reducing histamine levels in the body. It has a calming effect on the muscles of the bronchial tubes and the whole body. Certainly, drug therapy for asthma can often be lifesaving; drugs, however, are not curative. You have to eliminate the underlying cause of asthma and replace magnesium to fully treat this condition. Without magnesium, asthma can become chronic, especially if the various triggers are not eliminated; even the fear of an attack can magnify the emotional component. Conventional allergy shots have been used for decades to try to trick the body into accepting irritating allergens but often do not work, especially when the condition is due to a nutrient deficiency.

According to Dr. Mildred Seelig, the drug treatment of asthma consists of magnesium-wasters such as beta-blockers, corticosteroids, and Ventolin (albuterol). The side effects of these drugs include severe magnesium deficiency, which can result in arrhythmia and sudden death.[1] Taking

theophylline (aminophylline) can cause loss of magnesium and suppression of vitamin B_6 activity, which is necessary for magnesium function. Prednisone wastes magnesium, causes sodium retention and fluid retention, suppresses vitamin D, and promotes increased urinary excretion of zinc, vitamin K, and vitamin C.[2]

Childhood asthma can be life-threatening, but safe methods of treating this condition are available and can be used along with medications. In a European study, a group of children who had deteriorated in spite of conventional drug therapy were given magnesium sulfate intravenously. Comparing the magnesium group with the placebo group, the magnesium group had lower clinical asthma scores and a significantly greater improvement in lung function over a ninety-minute period. No significant side effects were observed.[3]

Dr. Lydia Ciarallo in the Department of Pediatrics, Brown University School of Medicine, treated thirty-one asthma patients ages six to eighteen who were deteriorating on conventional treatments. One group was given magnesium sulfate and another group was given saline solution, both intravenously. At fifty minutes the magnesium group had a significantly greater percentage of improvement in lung function, and more magnesium patients than placebo patients were discharged from the emergency department and did not need hospitalization.[4]

Another study showed a correlation between intracellular magnesium levels and airway spasm. The investigators found that patients who had low cellular magnesium levels had increased bronchial spasm. This finding confirmed not

only that magnesium was useful in the treatment of asthma by dilating the bronchial tubes but that lack of magnesium was probably a cause of this condition.[5]

A team of researchers identified magnesium deficiency as surprisingly common, finding it in 65 percent of an intensive-care population of asthmatics and in 11 percent of an outpatient asthma population. They supported the use of magnesium to help prevent asthma attacks. Magnesium has several antiasthmatic actions. As a calcium antagonist, it relaxes airways and smooth muscles and dilates the lungs. It also reduces airway inflammation, inhibits chemicals that cause spasm, and increases anti-inflammatory substances such as nitric oxide.[6]

The same study established that a lower dietary magnesium intake was associated with impaired lung function, bronchial hyperreactivity, and an increased risk of wheezing. The study included 2,633 randomly selected adults ages eighteen to seventy. Dietary magnesium intake was calculated by a food frequency questionnaire, and lung function and allergic tendency were evaluated. The investigators concluded that low magnesium intake may be involved in the development of both asthma and chronic obstructive airway disease.

DIET

Avoid sugar and white flour products. Limit red meat and dairy, which contain substances that increase inflammation in the body. Increase yellow vegetables and green leafy vegetables, which contain substances that inhibit inflammation. Increase intake of fish oils, seed and nut oils, cold-water fish (herring, sardines, salmon), flaxseed oil, and walnuts to reduce inflammation. Eat grapes; grape skins contain quercetin, which prevents histamine release and inhibits inflammatory products.

Try a liquid diet: use a whey, hemp, or pea protein powder, a green drink, and/or fresh, organic juices plus fiber for three days, followed by a vegetarian diet for four days.

Get out of the rut of eating the same foods every day; avoid your top three favorite foods to eliminate possible food allergies (people often crave foods they are sensitive to). Eggs, shellfish, and peanuts usually cause immediate sensitivity reactions; milk, chocolate, wheat, citrus, and food colorings cause delayed food reactions. Carefully check labels in the grocery store and speak up in restaurants to avoid even small amounts of potential allergic triggers such as MSG, aspartame, and sulfites.

Avoid aspirin and nonsteroidal anti-inflammatories (e.g., ibuprofen), which can cause allergic reactions.

Clean out environmental allergens: Find other homes for cats and dogs. Avoid wall-to-wall carpeting, wall hangings, and feather pillows. Frequently replace or clean air filters for heating and cooling systems. Obtain environmentally sound cleaning products. Use a vacuum cleaner specifically

for allergies. Research HEPA air cleaners for your home. Since yeast overgrowth may be related to asthma, read *The Yeast Connection and Women's Health* (Crook and Dean, 2005) to understand the association.

SUPPLEMENTS FOR ASTHMA

First Line of Treatment:

ReMag: (Picometer-ionic)150 mg 2–3 times a day and/or

Magnesium citrate: 300 mg twice a day

ReLyte Mineral solution. Dosage: ½ tsp three times a day

Vitamin B complex: 2 per day. Food-based, Grown by Nature

Second Line of Treatment to be added to the above if necessary:

Vitamin B_6: 25 mg twice daily

Pantothenic acid: 500 mg daily

Vitamin C: 1–2 g daily

Vitamin E as mixed tocopherols: 400 IU daily

Quercetin (a bioflavonoid]: 500 mg three times a day

Flaxseed oil: 1–2 tbsp daily

Hydrochloric acid: 5 grains, one tablet per day at the end of a meal, increasing to one with each meal

Probiotics: Prescript-Assist, 1 per day at night

CHAPTER FIFTEEN

HEALTH AND LONGEVITY

THREE THINGS YOU NEED TO KNOW ABOUT MAGNESIUM AND AGING

1. Magnesium is deficient in people who have Alzheimer's disease or Parkinson's disease.
2. Aging itself is a risk factor for magnesium deficiency; as we get older we become more deficient in magnesium and therefore require more in our diet and in supplement form.
3. Magnesium oil applied to the skin stimulates production of DHEA, the antiaging hormone.

Three hundred years ago, people didn't live as long as we do today. They lived in such unsanitary conditions that simple scrapes and cuts became mortal wounds. Bathing was looked upon with suspicion. Tuberculosis, fostered by extremely close quarters, little sun exposure, dampness, and lack of fresh vegetables, was highly contagious and struck down many in their prime. Indoor fires without

adequate ventilation caused chronic bronchitis and emphysema, if the people even lived long enough to develop these conditions.

When we implemented universal sanitation, the infectious diseases began to recede. The land was still fertile, and plants soaked up vital nutrients. Farm animals ate the plants, and humans absorbed the nutrients from eating fresh meat and fresh produce. The industrial revolution, however, harmed our health in a new way, with factories belching smoke and chemical poisons. Industrial farming techniques began poisoning the soil with pesticides, herbicides, and nitrogen fertilizers. The soil became lifeless.

We may think we are better off in this century with our drugs and medical technology, but as we've seen, these can also become toxic and undermine our health, especially in a polluted environment where our basic nutrition is impaired. Popping antiaging pills and megavitamins, however, does *not* add years to your life. An excellent diet that provides optimal nutrients, exercise, and an outgoing, optimistic attitude are the true keys to longevity.

Aging in industrialized societies is associated with an increasing prevalence of hypertension, heart disease, reduced insulin sensitivity, and adult-onset diabetes. Aging in general is associated with altered calcium and magnesium ion levels, indistinguishable from those observed in hypertension and diabetes.[1] As noted in the introduction to Part Three, French magnesium researcher Dr. Pierre Delbet, who practiced in the early 1900s, was convinced that the aging body's tissues have three times

more calcium than magnesium. He knew that calcium precipitates out into tissues that have a deficiency of magnesium. He observed the toxicity of excess calcium in the testicles, brain, and other tissues and concluded almost a century ago that magnesium deficiency plays a role in senility. In Chapter 8 we talked about insulin resistance and its role in exacerbating hypertension, heart disease, and diabetes mellitus. Insulin-resistant states, as well as what is often thought of as "normal" aging, are characterized by the accumulation of calcium and depletion of magnesium in the cells. With this in mind, clinical researchers in this century are finally suggesting that it is the disturbance of calcium and magnesium ions that might be the missing link responsible for the frequent clinical coexistence of hypertension, atherosclerosis, and metabolic disorders in aging.[2]

As is evident from animal experiments and epidemiological studies, magnesium deficiency may increase our susceptibility to cardiovascular disease as well as accelerate aging.[3] In a study of nursing home residents, low magnesium levels were significantly associated with two conditions that plague the elderly, calf cramps and diabetes mellitus.[4] Centenarians (individuals reaching a hundred years of age) have higher total body magnesium and lower calcium levels than most elderly people.[5]

"Smart drugs" such as piracetam, oxiracetam, pramiracetam, and aniracetam are thought to enhance learning, facilitate the flow of information between the

two hemispheres of the brain, help the brain resist physical and chemical injuries, and be relatively free of side effects. Magnesium fits all the criteria for “smart drugs,” but it is much less costly and has no side effects.

FREE RADICALS, ANTIOXIDANTS, AND AGING

A free radical is an unstable molecule that is the product of normal body metabolism. It is formed when molecules within our own body's cells react with oxygen. It has an unpaired electron that tries to steal a stabilizing electron from another molecule and as a consequence can produce harmful effects. External sources of free radicals include chemicals (pesticides, industrial pollution, auto exhaust, cigarette smoke), heavy metals (dental amalgam, lead, cadmium), most infections (viruses, bacteria, parasites), X-rays, alcohol, allergens, stress, and even excessive exercise.

Antioxidants are vitamins and minerals such as magnesium, selenium, vitamin C, and vitamin E that turn off free radicals. The greater the amount of other antioxidants in the body, the more magnesium is spared from acting as an antioxidant and is free to perform its many other functions. So taking supplemental antioxidants protects the level of magnesium in the body; this prevents elevation of calcium, which can lead to vascular muscle spasm.[6] If there are not enough antioxidants available, overabundant free radicals begin to damage and destroy normal, healthy cells. Free radicals are necessary and normal products of metabolism, but uncontrolled free radical production plays a major role in the development of degenerative disease, since free radicals can damage any body structure: proteins, enzymes, fats, even DNA. Free radicals are implicated in more than sixty different health conditions, including heart disease, autoimmune disease, and cancer.

According to current research, low magnesium levels not

only magnify free radical damage but can hasten the production of free radicals.[7] One study utilizing cultures of skin cells found that low magnesium doubled the levels of free radicals.[8] In addition, cells grown without magnesium were twice as susceptible to free radical damage as were cells grown in normal amounts of magnesium. Another study showed that red blood cells from hamsters fed low-magnesium diets were deficient in magnesium and consequently more susceptible to free radical damage. It appears that low magnesium damages the vital fatty layer in the cell membrane, making it more susceptible to destruction and allowing leakage through the membrane. This particular finding, which implicates magnesium deficiency as one of the causes of leaky cell membranes, is extremely important because disruption of this type can be fatal to cells and cause widespread problems that ultimately manifest in the list of conditions and symptoms of magnesium deficiency on this page.

A number of reports have identified pesticides as a cause of Parkinson's disease (which affects over a million Americans), with in-home exposure to insecticides carrying the highest risk.[9] Glutathione is a naturally occurring antioxidant made in all the cells of the body, including neurons, which acts to detoxify the body of certain chemicals. Cells grown in magnesium-deficient conditions, however, have lower glutathione levels. Adding free radicals to a low-magnesium cell culture causes the level of glutathione to fall rapidly as it is used up, making the cells much more susceptible to free radical damage. Neurosurgeon Dr. Russell Blaylock tells us that a fall in

cellular glutathione within part of the brain called the substantia nigra appears to be one of the earliest findings in Parkinson's disease.[10]

MEMORY

It's much easier to view the tangible and structural benefits of magnesium—the bones, proteins, and even the energy it produces—but much more difficult to contemplate its effects on the brain. Research at MIT, however, produced a study in 2004 that elevates magnesium to the position of memory enhancer.

It appears that particular brain receptors important for learning and memory depend on magnesium for their regulation. The researchers describe magnesium as absolutely necessary in the cerebrospinal fluid in order to keep these learning and memory receptors active. The term they use for this activity, interactivity, and changeability is *plasticity*.

Plasticity decreases with age, and it's the loss of plasticity in the brain region responsible for storing short-term memories that causes forgetfulness in the elderly. Magnesium, they found, is instrumental in opening the receptor to important information, yet at the same time being able to ignore background noise. The researchers were quite struck by their findings and concluded, "As predicted by our theory, increasing the concentration of magnesium and reducing the background level of noise led to the largest increases of plasticity ever reported in scientific literature."[11]

ALZHEIMER'S

In North America, approximately 10 percent of the population over sixty-five and 50 percent over eighty-five suffer from Alzheimer's. It is associated with severe memory loss, impaired cognitive function, and inability to carry out activities of daily life. Alzheimer's disease should be diagnosed only when all the other identifiable brain conditions are ruled out (e.g., brain tumor, alcoholism, vitamin B_{12} deficiency, mercury amalgam poisoning, depression, hypothyroidism, Parkinson's, stroke, excessive prescription drug use, malnutrition, and dehydration). In truth, it is only at autopsy that a definitive diagnosis can be made, as the brain will show the identifying characteristics of Alzheimer's: plaques and tangles in the nerve fibers, particularly in the cerebral cortex and hippocampal area. Dr. Abram Hoffer, the founder of orthomolecular medicine along with Linus Pauling, cautions that almost half the cases of what is assumed to be Alzheimer's may in fact be dementias caused by such treatable conditions as simple dehydration, prescription drug intoxication, severe cerebral allergies to foods or chemicals, or chronic nutrient deficiencies. Drugs that worsen Alzeimer's include chlorpromazine, antihistamines, barbiturates, psychotropic drugs, and diuretics.

Chemicals and toxic metals are associated with Alzheimer's disease, especially mercury and aluminum. The Alzheimer's-mercury connection has been made by Dr. Boyd Haley, a professor of chemistry and chair of that department at the University of Kentucky. Dr. Haley proved that the tangles and plaques in the Alzheimer's

brain were identical to those produced by mercury poisoning. Mercury can be absorbed into the brain from dental amalgams, be acquired by taking flu shots (which are preserved with mercury), or come from habitually eating fish contaminated with mercury. Magnesium, when it is available in the body, will help detoxify heavy metals, even ones as poisoinous as mercury.

Many Americans are exposed to aluminum through aluminum pots, aluminum cans, aluminum-containing antacids and antiperspirants, aluminum foil, and tap water that may be high in aluminum.[12], [13] Considerable research has proven that brain neurons affected in Alzheimer's disease have significantly higher levels of aluminum than normal neurons. Alzheimer's patients also have consistently low magnesium levels within the hippocampus, the area of the brain most damaged by Alzheimer's. Aluminum is able to replace magnesium in certain enzyme systems in the body, mimicking its function but causing harm. Aluminum can also replace magnesium in the brain, which leaves calcium channels in the brain nerve cells wide open, allowing calcium to flood in, causing cell death.[14]

William Grant, an atmospheric scientist, had a personal interest in Alzheimer's because of a strong family history. Grant already knew that people with Alzheimer's typically have elevated concentrations of aluminum in their brains. He put that bit of information together with the fact that acid rain makes aluminum more abundant in trees and seems to make trees age prematurely. Grant theorized that the diets of Alzheimer's patients might be very acidic, leaching calcium and magnesium from the body. He found

that people with Alzheimer's have elevated amounts of aluminum, iron, and zinc and have reduced amounts of alkali metals such as magnesium, calcium, and potassium, which neutralize the acidity in the diet. A typical Western diet—high in protein, fat, and sugar—is acid-forming and may be an additional factor in creating aluminum overload in Alzheimer's.

PARKINSON'S DISEASE

Similarly, aluminum can be a contributing factor in the central nervous system degeneration that occurs with Parkinson's disease. In one autopsy study, calcium and aluminum were elevated in the brains of victims of Parkinson's disease as compared to people with normal brains.[15]

Enzymes function in the body only when they have access to the proper cofactors, which are mostly vitamins and minerals, especially magnesium, selenium, vitamin C, vitamin B_6, and vitamin E. Heavy metals such as cadmium, aluminum, and lead attach themselves to certain enzymes, kicking out minerals such as magnesium, and either prevent the normal enzyme activity or create abnormal activity leading to cell destruction.

Research indicates that ample magnesium will protect brain cells from the damaging effects of aluminum, beryllium, cadmium, lead, mercury, and nickel. We also know that low levels of brain magnesium contribute to the deposition of heavy metals in the brain that heralds Parkinson's and Alzheimer's. It appears that the metals compete with magnesium for entry into the brain cells. If magnesium is low, metals gain access much more readily.

There is also competition in the small intestine for absorption of minerals. If there is enough magnesium, aluminum won't be absorbed. When monkeys are fed diets low in calcium and magnesium but high in aluminum, for instance, they become apathetic and begin to lose weight. When their spinal cords are examined under the microscope, they show swelling of the anterior motor cells

(movement centers), plus accumulation of calcium and aluminum in these cells.[16] If you eat from aluminum pots, use aluminum-containing antiperspirants, wrap your food in aluminum foil, and drink tap water with high aluminum content, the levels could overwhelm the magnesium in your gut, and aluminum will be absorbed instead. This has consequences for the amount of magnesium in your brain and may allow the buildup of aluminum associated with Alzheimer's and Parkinson's disease.

Dr. Blaylock reports that when scientists study the soil of regions that have a high incidence of neurological diseases, they find high levels of aluminum and low levels of magnesium and calcium. The neurons from victims of the disease also show high levels of aluminum and low levels of magnesium. On the island of Guam the areas with the lowest levels of calcium and magnesium in the soil are also the areas of highest incidence for all neurological diseases. Magnesium plays a vital role in protecting neurons from the lethal effects of aluminum.[17]

MAGNESIUM-DEFICIENCY DEMENTIA

Dementia may also be caused by magnesium depletion alone.[18] Several studies show that severe neurological syndromes can result when conditions cause extremely low levels of brain magnesium, such as with the chronic use of diuretics, which millions of people take to control high blood pressure. These neurological conditions can present as seizures, delirium, coma, or psychosis, which are quickly reversed by administering large doses of intravenous magnesium.

The body's ability to absorb magnesium declines with age, so at particular risk are elderly people who do not eat an adequate diet and who use drugs that deplete the body's magnesium. (Studies show that senior citizens take on average six to eight medications regularly.) Add to that the effects of antacids, which many elderly people take to cover up symptoms caused by a bad diet. Antacids suppress normal stomach acid and can lead to incompletely digested food, which causes gas, bloating, and constipation. (As previously noted, another hidden danger is the use of aluminum in most antacids.)

Excessive amounts of aspartame and MSG (glutamate) in the diet of elderly people may also cause symptoms of dementia due to their direct effect, which is also magnified in magnesium deficiency.

AGING

Dr. Jean Durlach, a preeminent magnesium expert in France, sums up the current research on magnesium and aging.[19]

1. Chronic marginal magnesium deficiency reduces life span in rats.
2. Magnesium deficiency accelerates aging through its various effects on the neuromuscular, cardiovascular, and endocrine apparatus; kidneys and bones; and immune, antistress, and antioxidant systems.
3. In developed countries, magnesium intake is marginal throughout the entire population regardless of age: around 4 mg/kg/day instead of the 6 mg/kg/day recommended to maintain satisfactory balance. However, diseases, handicaps, and physical or psychological impairments expose elderly individuals to more severe nutritional deficiencies.
4. Around the age of seventy, magnesium absorption is two-thirds of what it is at age thirty.
5. Various mechanisms of deficiency include intestinal malabsorption; reduced bone uptake and mobilization (osteoporosis); increased urinary losses; chronic stress; insulin resistance leading to diabetes with severe magnesium loss in the urine; lack of response to adrenal stimulation; loss caused by medication, especially diuretics; alcohol addiction; and cigarette smoking.

6. Magnesium deficiency symptoms in the elderly include central nervous system symptoms that seem largely “neurotic”: anxiety, excessive emotionality, fatigue, headaches, insomnia, light-headedness, dizziness, nervous fits, sensation of a lump in the throat, and impaired breathing. Peripheral nervous system signs are common: pins and needles of the extremities, cramps, muscle pains. Functional disorders include chest pain, shortness of breath, chest pressure, palpitations, extra systoles (occasional heart thumps from an isolated extra beat), abnormal heart rhythm, and Raynaud’s syndrome. Autonomic nervous system disturbances involve both the sympathetic and parasympathetic nervous systems, causing hypotension on rising quickly or borderline hypertension. In elderly patients, excessive emotionality, tremor, weakness, sleep disorders, amnesia, and cognitive disturbances are particularly important aspects of magnesium deficiency.

7. A trial of oral magnesium supplementation is the best diagnostic tool for establishing the importance of magnesium.

MAGNESIUM OIL AND DHEA

Dr. Norman Shealy found while researching magnesium oil that magnesium applied to the skin on a regular basis naturally enhances the level of a vitally important hormone, DHEA. DHEA is normally produced in the adrenal glands, but production slows down as we age. Apparently as magnesium is absorbed through the skin and the underlying fatty tissues of the body it sets off many chain reactions, one of which ends in the production of DHEA.

Increasing DHEA levels by taking supplements of the hormone is recommended by some antiaging specialists, but others caution about side effects. To increase it naturally by improving your magnesium balance may be a safe way to turn back the clock.

TREATMENT BEYOND MAGNESIUM

MANAGEMENT OF ALUMINUM TOXICITY AND ALZHEIMER'S

Use only filtered water, and ensure that the filter guarantees removal of aluminum; drink eight glasses per day. Check labels and avoid antacids containing aluminum. Use natural antiperspirants. Avoid cooking in aluminum pots or drinking fruit juice or soft drinks from aluminum containers. Get checked for thyroid disease and treat appropriately. Check for heavy metal toxicity (aluminum, mercury, copper, lead, and iron) through urine testing or hair analysis. Pursue either oral or intravenous chelation to remove your heavy-metal burden.

ALTERNATIVE THERAPIES FOR ALZHEIMER'S

Avoid mercury fillings or have them replaced; if you decide to have your mercury amalgams removed, find a practitioner who has been trained in their safe removal, as improper removal can result in more mercury being released into the tissues (see the Resources list). Clean out all the chemicals in your home and immediate environment. Eat organic food. Exercise and take regular saunas.

DIET FOR LONGEVITY

Avoid all junk food and salty, fried, and fatty foods. Stay away from meat, alcohol, coffee, caffeine, and sugar. Check for food sensitivities, particularly wheat and dairy. Therapeutic foods include cilantro, onion, seaweeds, and

ginger, which help bind and excrete heavy metals.

SUPPLEMENTS FOR LONGEVITY

ReMag: (Picometer-ionic)150 mg 2–3 times a day and/or

Magnesium citrate: 300 mg two times per day

Magnesium oil applied to the skin (don't rub in), 10–20 sprays per day (each spray carries about 20 mg of magnesium).

Calcium: dietary and/or bone broth, 700mg (see this page for food lists and this page for bone broth recipe)

ReLyte: Mineral-Electrolyte Solution. ½ tsp three times a day

Vitamin E as mixed tocopherols: 400 IU daily

Vitamin C: 1,000 mg twice per day

Vitamin B complex: 2 per day. Food-based, Grown by Nature

Vitamin B_{12}: 1,000 mcg intramuscularly weekly

Vitamin D, A, and K_2 from Blue Ice Royal (fermented cod liver oil and butter oil: 2 capsules per day)

Vitamin D: 20 minutes of sun exposure daily if possible

Lecithin granules: 2 tbsp per day

Flaxseed oil: 1–2 tbsp per day

Ginkgo biloba and gotu kola are two herbs that can improve cerebral circulation.

PART FOUR

TESTING AND SUPPLEMENTS

CHAPTER SIXTEEN

MAGNESIUM REQUIREMENTS AND TESTING

It's confusing enough trying to determine your individual needs for magnesium without having to wade through the alphabet soup of guidelines set by government agencies, including the DRI, RDA, RDI, AI, UL, and EAR. In 1997, the Food and Nutrition Board of the National Academy of Sciences created the Dietary Reference Intakes (DRIs), which added more guidelines to the Recommended Dietary Allowances (RDAs) that were the standard from 1941 to 1989. Statistical analysis of diets for certain nutrients is necessary for the planning of menus to meet the nutrient needs of different age groups of people. They are also used to evaluate food consumption patterns and to create guidelines for nutrition labeling, all with an eye to preventing nutrient deficient diseases. This is an important point to remember: the RDA nutrient intake guidelines did not recommend levels for optimal health and vitality but told you how much vitamin C to take, for example, so you won't get scurvy, or vitamin B_1, so you won't get pellagra.

The DRIs are now made up of four different reference values: the Estimated Average Requirement (EAR), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI), and the Tolerable Upper Intake Level (UL). The UL is most important because it focuses on higher

intake levels than the RDA to reduce the risk of chronic diseases such as osteoporosis, cancer, and cardiovascular disease.

Implementation of the DRIs was done in stages from 1997 to 2005. Focusing on the prevention of osteoporosis, the first report, published in 1997, was the *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride*. Four additional reports have covered folate and other B vitamins; dietary antioxidants (vitamins C and E, selenium, and the carotenoids); the micronutrients (vitamins A and K, and trace elements such as iron, iodine, etc.); macronutrients such as dietary fat and fatty acids, protein and amino acids, carbohydrates, sugars, and dietary fiber, as well as energy intake and expenditure; electrolytes and water; bioactive compounds such as phytoestrogens and phytochemicals; and the role of alcohol in health and disease.

While the DRIs are used mainly by academic research scientists and nutritionists and are not a household word, doctors who focus on nutrition, such as myself, appreciate having the information in these reports. The confusing part in the magnesium report is that two different values are given for dietary magnesium and for supplemental magnesium. There is no total requirement and no acknowledgment that the level of magnesium in the average diet is less than half the RDA.

In 1997, the RDA of magnesium was raised 15 percent, from 350 mg/day to 420 for men and from 280 mg/day to 320 for women. However, the same 1997 report on the safe upper limit of dietary magnesium for adults states that

"because magnesium has not been shown to produce any toxic effects when ingested as a naturally occurring substance in foods, a UL cannot be established for dietary magnesium at this time." The report also noted that "no specific toxicity data exist on which to establish a UL [for dietary magnesium] for infants, toddlers, and children." In determining the dietary magnesium UL for pregnant and breast-feeding women, it concluded that "studies involving intravenous administration of comparatively large doses of magnesium used in the treatment of preterm labor, pregnancy-induced hypertension, or other clinical conditions were not considered applicable for the derivation of ULs."

Looking at supplemental magnesium, the committee set what some consider to be a very low UL for pregnant and breast-feeding women, despite their high magnesium needs. Even though the report states that "no evidence suggests increased susceptibility to adverse effects of supplemental magnesium during pregnancy and lactation," they set the UL for this group at 350 mg (14.6 mmol)/day. This is the same UL for supplemental magnesium in adults who are not pregnant or lactating.

The report does concede that supplements above the UL may be necessary. "Individuals with impaired renal function are at greater risk of magnesium toxicity. However … magnesium levels obtained from food are insufficient to cause adverse reactions even in these individuals. Patients with certain clinical conditions (for example, neonatal tetany, hyperuricemia, hyperlipidemia, lithium toxicity, hyperthyroidism, pancreatitis, hepatitis,

phlebitis, coronary artery disease, arrhythmia, and digitalis intoxication …) may benefit from the prescribed use of magnesium in quantities exceeding the UL in the clinical setting."

MAGNESIUM REQUIREMENTS

As noted, the Recommended Daily Allowance (RDA) for nutrients is set at the minimum level to stave off deficiency symptoms, not at the optimum that ensures good health. But even with the RDA set so low, most Americans are still deficient in magnesium, with men obtaining only about 80 percent of the recommended daily allowance (RDA) and women averaging only 70 percent.

The following table shows the Recommended Daily Allowances (RDAs) for magnesium in children and adults.

Children 1 to 3 years: 80 mg
Children 4 to 8 years: 130 mg
Children 9 to 13 years: 240 mg

Life Stage	Men	Women	Pregnancy	Lactation
Age 14–18	410 mg	360 mg	400mg	360 mg
Age 19–30	400 mg	310 mg	350 mg	310 mg
Age 31+	420 mg	320 mg	360 mg	320 mg

The RDA for magnesium is also expressed in mg/kg and is roughly 6 mg per kg (2.2 lb) of body weight. This standard helps to determine the magnesium requirements for someone who is overweight; a fifty-year-old who weighs 300 lbs needs more magnesium than a fifty-year-old who is 100 lbs.

Many magnesium experts feel that the RDA should be increased. Twenty years of research shows that under ideal

conditions approximately 300 mg of magnesium is required merely to offset the daily losses. If you are under mild to moderate stress caused by a physical or psychological disease, physical injury, athletic exertion, or emotional upheaval, your requirements for magnesium escalate.[1], [2] Dr. Mildred Seelig felt that athletic adolescent boys and girls may need 7–10 mg/kg/day and pregnancy requirements should be a minimum of 450 mg a day or up to 15 mg/kg/day.[3] An average good diet may supply about 120 mg of magnesium per 1,000 calories, for an estimated daily intake of about 250 mg.[4], [5] Since at best the body is actually absorbing only half of what is taken in, researchers feel that most people would benefit from magnesium supplementation. Otherwise, body tissue must be broken down to supply vital areas of the body with essential magnesium.[6], [7]

MAGNESIUM TESTING

You've heard the saying "To err is human, to forgive is divine"? In the medical world, to err is human, to test is divine.

Laboratory tests should be used to confirm what our senses and intuition tells us, but all too often doctors place all their faith in tests. Yet finding the definitive test for a condition, which can clinch a diagnosis, makes both doctor and patient feel safe. Over the years lab testing for minerals evolved from measurements done on whole blood to isolating minerals inside cells. The present state of the art, however, lies in testing mineral ions, which are the active component of minerals working at the tissue level. As mentioned throughout *The Magnesium Miracle*, much of the current research on magnesium has made use of Ionized Magnesium Testing to measure magnesium at work in the cells; however, that testing is still not readily available to the public. The Magnesium RBC test, discussed below, is a much more available magnesium test—although not as accurate as Ionic Magnesium Testing, it is more accurate than serum magnesium testing.

There are two clinical tests that can be done in a doctor's office, the results of which can indicate both calcium deficiency and magnesium deficiency: Chvostek's sign (a contraction of the facial muscles caused by tapping lightly on the facial nerve located in front of the ear) and Trousseau's sign (a spasm of the hand muscles caused by applying a tourniquet or blood pressure cuff to the forearm below the elbow for three minutes). But since neither test distinguishes calcium deficiency from magnesium

deficiency, doctors use the tests to only diagnose and treat calcium deficiency. As a result, if calcium supplements are recommended based on either of these tests, magnesium levels are driven even lower, causing more magnesium-deficiency symptoms.

SERUM (BLOOD) MAGNESIUM TEST

In spite of, or perhaps because of, all the metabolic processes that rely on magnesium, less than 1 percent of our body's total magnesium can be measured in our blood; the rest is busily occupied in the cells and tissues or holding our bones together. Therefore, it is virtually impossible to make an accurate assessment of the level of magnesium in various body tissue cells using a routine serum magnesium test. This test is often called a total serum magnesium test, which you might imagine relates to all the magnesium in your body—but it does not. Magnesium in the blood does not correlate with the amount of magnesium in other parts of your body. In fact, if you are under the stress of various ailments, your body pumps magnesium out of the cells and into the blood, giving the mistaken appearance of normality on testing in spite of bodywide depletion. Unfortunately, most magnesium evaluations done in hospitals and in laboratories use the antiquated serum magnesium test.

RED AND WHITE BLOOD CELL MAGNESIUM TESTS

All body cells, including red and white blood cells, contain magnesium—up to 40 percent of the body's total. Because red blood cells are 500 times more abundant in blood than white blood cells, they are the preferred test material. Studies show that blood cell magnesium is a much more accurate measure of total body magnesium than the serum magnesium test. One study in childhood asthmatics compared serum magnesium levels to total white blood cell magnesium levels. While serum magnesium became elevated on the first day of an asthma attack, the white blood cell magnesium levels dropped dramatically, indicating the real state of affairs. As mentioned above, under stress magnesium is released from the cells, depleting them as it floods into the bloodstream.[8]

THE BUCCAL CELL SMEAR TEST (EXATest)

Using cells gently scraped from an area in the mouth between the bottom teeth and the back of the tongue provides an accurate means of measuring the amount of magnesium in the cells of the body. Measuring cellular magnesium in this way indicates the amount of magnesium in heart and muscle cells, the two major body tissues affected by magnesium deficiency.

The buccal cell smear test can be used to sample many things in cells; however, IntraCellular Diagnostics has developed a testing procedure called EXATest specifically to identify the amounts of certain minerals in the cell. The company sends sampling kits to your doctor's office, where a simple procedure, which takes about 60 seconds, is performed. Your doctor uses a wooden spatula to scrape off superficial layers of cells under your tongue. The scrapings are carefully placed on a microscope slide and sent back to the lab. A special electron microscope then measures the amount of magnesium and other minerals in the sample on the slide. The results are sent back to your doctor. The test is expensive but may be covered by Medicare and insurance.

For those who are curious about the details of the testing, an analytical scanning electron microscope with high-tech, computerized elemental X-ray analysis (EXA) bombards the specimen with high-energy electrons, whereupon energy is released in the form of wavelengths that are distinct and unique to each mineral element. A computer measures the wavelengths and calculates what is called a "spectral fingerprint" for each patient that identifies the mineral

levels and ratios within the cell. See the Resources section for IntraCellular Diagnostics contact information.

THE MAGNESIUM CHALLENGE TEST

Time-consuming and cumbersome but necessary for people who may be magnesium wasters, the magnesium challenge test requires twenty-four-hour urine collections on two separate occasions. The first urine collection is done when you are taking your normal supplements. Then, in the doctor's office, a dose of 2 meq/kg of magnesium chloride or magnesium sulfate is given intravenously, infused over a four-hour period. A second urine collection begins after the IV, and every urine sample is collected for twenty-four hours. Deficiency is diagnosed when the body exhibits a need for magnesium by holding on to more than 25 percent of the magnesium given. A decade ago, the magnesium challenge test was the best method of determining body stores.[9] While today comparison studies using magnesium challenge and ionized magnesium indicate that ionized magnesium testing appears to be a better indicator and is more easily done (see next section),[10] the ionized magnesium test is currently not available except for research purposes, so the magnesium challenge test should be used.

The magnesium challenge test can diagnose magnesium wasting. If more than 75 percent of the magnesium given in the IV test is excreted, the assumption is that you have enough magnesium and are not deficient. However, if a clinical assessment is made that you have magnesium deficiency symptoms and you lose most of the magnesium given by IV, then magnesium wasting is the probable diagnosis. The treatment for magnesium wasting is to take IV magnesium or use magnesium oil transdermal

applications as described in Chapter 18.

BLOOD IONIZED MAGNESIUM TEST

The blood Ionized Magnesium Test, pioneered and tested extensively at the State University of New York Downstate Medical Center in Brooklyn by magnesium researchers Bella and Burton Altura, is the most accurate and reliable magnesium blood test available but presently limited to research use. The Alturas have researched the health effects of magnesium since the 1960s and did the original research for the test in 1987.[11], [12], [13], [14], [15], [16]

The Ionized Magnesium Test is a very refined procedure, backed up by results on many thousands of patients with over twenty-two different disease states and published in dozens of journals, including five papers in *Science* and papers in the prestigious *Scandinavian Journal of Clinical Laboratory Investigation* and *Scientific American*.[17] To determine the efficacy and efficiency of the new test, research included a comparison of magnesium levels found with the Alturas' Ionized Magnesium Test to levels found in various body tissues using expensive and sensitive digital imaging microscopy, atomic absorption spectroscopy, and the magnesium fluorescent probe. The blood Ionized Magnesium Test came through as a highly sensitive, convenient, and relatively inexpensive means of determining magnesium status in healthy or ill subjects.

Here's how it works. Magnesium exists in the body either as active magnesium ions bound to nothing or as inactive magnesium complexes (such as magnesium citrate) bound to proteins or other substances. A magnesium ion is an atom that is missing two electrons, which makes it search to attach to something that will replace its missing

electrons. Magnesium ions constitute the physiologically active fraction of magnesium in the body; they are not attached to other substances and are free to join in biochemical body processes.[18]

Most clinical laboratories assess only *total* serum magnesium, which includes both active and inactive types. Since there is only 1 percent of the body's magnesium in the blood, however, the test samples only that 1 percent. With the blood ionized magnesium test it is now possible to directly measure the levels of magnesium ions in whole blood, plasma, and serum using ion-selective electrodes that gives an accurate accounting of the actual magnesium at work in the body.[19]

For example, ionized magnesium testing on 3,000 migraine patients shows that 90 percent of those with low magnesium ion levels improve with magnesium therapy. In 85 to 90 percent of all patients tested, low magnesium ion levels match tissue levels of free magnesium and accurately diagnose magnesium deficiency found in asthma, brain trauma, coronary artery disease, types I and II diabetes, gestational diabetes, eclampsia and preeclampsia, heart disease, homocysteinuria, hypertension, tension headaches, posttraumatic headaches, ischemic heart disease, liver transplant patients, renal transplant patients, polycystic ovarian disease, stroke, and syndrome X. In many of these conditions, low magnesium ion levels exist in spite of normal serum magnesium levels, making the ionized magnesium test more reliable for magnesium deficiency.[20], [21], [22], [23], [24], [25], [26], [27], [28], [29]

Because laboratories are slow to acquire new equipment,

at present the FDA-approved ionized magnesium test is unfortunately mainly limited to the Alturas' laboratory and used mostly for research purposes. In the past, the Alturas have provided this test to doctors who sent in their patients' blood, but that avenue is less available now and few other labs are using the test. (See the Resources section for further information on the ionized magnesium test.)

THE ORAL CLINICAL TRIAL

For the average individual, one way to diagnose magnesium deficiency is simply to try supplementing. For one to three months take magnesium while recording all changes in your physical and mental health. It may be best to do this under a health professional's guidance, especially if you are on medications or have an existing medical condition. But we have long been our own caretakers and that freedom should not be taken from us. The alleviation of symptoms after thirty to ninety days constitutes the best proof that you had a magnesium deficiency. Add magnesium oil or picometer magnesium spray to enhance the effects of oral supplementation. See the Introduction and this page for forms of magnesium and dosage.'

FALSE-POSITIVE MAGNESIUM TESTS

The lack of adequate tools to measure magnesium in most hospitals and clinics is one of the main reasons medical doctors do not prescribe it. A serum magnesium test is actually worse than ineffective, because a test result that is within normal limits lends a false sense of security about the status of the mineral in the body. It also explains why doctors don't recognize magnesium deficiency; they assume serum magnesium levels are an accurate measure of all the magnesium in the body. Magnesium researchers also mostly use serum magnesium tests to determine magnesium status in their test subjects. As they begin to use the more accurate ionized magnesium test, however, the results will indicate even more widespread deficiency in the population.

CHAPTER SEVENTEEN

A MAGNESIUM EATING PLAN

Good nutrition creates a solid structural foundation of tissue and bone as well as nutrients for making hormones and neurotransmitters. The basis of good nutrition is the consumption of protein, minerals, trace minerals, vitamins, amino acids, and essential fatty acids. Clearly there is more to life than magnesium, but life can't exist without it. Just as important as magnesium is calcium, and the magnesium eating plan will also focus on how much calcium you need in your diet and in your supplement bottle.

The present American diet is heavily biased toward processed flour, sugar, and unhealthy fats. Over one-quarter of our diet may consist of what are in essence nonfoods that don't contain even a smattering of healthy nutrients. Magnesium is banished during food processing and never replaced, as some nutrients are, in fortified foods.

George Eby, whose foundation provided funds to educate members of Congress about magnesium and present them with copies of *The Magnesium Miracle*, has a personal interest in magnesium, having suffered from magnesium deficiency for many years. He is convinced that magnesium deficiency causes 50 to 70 percent of all our chronic illnesses and accounts for a huge share of medical and

hospital expenses. He's also concerned that because most of us have grown up in a society with widespread magnesium deficiency, which began about 100 years ago with the large-scale refining of grain, we are unable to recognize that we are deficient. Eby says that white flour should be called not "refined" wheat but "depleted" wheat, and points to the November 2002 issue of the *Harvard Heart Letter*, which shows that only 16 percent of the magnesium remains after wheat is refined.

Eby reminds us that other critical nutrients, such as vitamins E and B_6, vital for proper absorption of magnesium, are also depleted by refining. However, magnesium is the main nutrient that is not adequately obtained by eating other foods. He says we are too fond of foods made with depleted wheat, such as pancakes, waffles, biscuits, tortillas, bread, cake, cookies, and doughnuts. These products take up a large amount of shelf space in grocery and convenience stores, mirroring our insatiable appetite for them. Clearly, he says, people love these foods —although a better verb would be *crave*, because people feel empty after eating depleted wheat, and keep eating more, perhaps searching for magnesium and other nutrients necessary for the body to function properly.

To obtain enough magnesium from the diet takes special care and knowledge of magnesium-rich foods, but we still need to supplement with magnesium. In 2005, Eby produced a DVD showing a long list of foods with the amounts necessary to deliver 400 mg of magnesium. Imagine 1.8 ounces of rice bran, which provides 400 mg of magnesium, beside 54.25 ounces of doughnuts, which is

the quantity you have to eat to obtain the same amount of magnesium. Or visualize a few ounces of nuts compared to 25 ounces of white bread. Such a picture, showing the nutrient deficiency of refined foods, is worth a thousand words.

FOODS CONTAINING 400 MG OF MAGNESIUM PER SERVING IN OUNCES

Food	Portion containing 400 mg
Rice bran, crude	1.8
Wheat bran, crude	2.3
Cocoa, dry powder	2.65
Pumpkin seeds	2.65
Brazil nuts	3.9
Peanut butter	3.9
Kellogg's All-Bran	3.9
Cashew nuts	4.80
Almonds	5.1

Quaker Oats	5.1
Baking chocolate	5.2
Molasses	5.3
Buckwheat flour	5.65
Oat bran	5.9
Wheat germ	5.9
Peanuts	8.0
Tortilla chips	14.5
Dinner rolls	16.6
Whole-wheat bread	17.3
English muffins	20
Potatoes	21.7
Spaghetti	22.0
Macaroni	22.0
Tortillas	22.0
Potato flour	22
Crackers	22.75

Melba toast	25
Bread, white	25
Potato chips	26
Brown sugar	48
Doughnuts	54.25

Statistics from USDA data

DIET SOLUTIONS TO MAGNESIUM DEFICIENCY

To enrich your diet with magnesium, increase your consumption of green vegetables, nuts, seeds, legumes, and unprocessed grains. Removing the germ and bran of cereals and further processing eliminates most of the magnesium present in the whole grain. It is a good idea to supplement a diet of vegetables, fruits, and protein-rich foods such as fish, meat, and milk by eating wheat germ, kelp, brewer's yeast, sunflower seeds, pumpkin seeds, and sea salt, which are all extremely rich in magnesium. Since one of the reasons you may be magnesium-deficient is from eating too much cooked and processed food, try to eat more raw foods. Fortunately, nuts, seeds, and many vegetables can be eaten raw, and raw wheat germ can be used on cereal and in protein drinks.

According to top French magnesium experts, highly effective heart-and blood-vessel-protective diets that reduce saturated fats, increase monounsaturated fat and omega-3 fatty acids (from fish and flaxseed), limit the consumption of alcohol, and increase the intake of cereals, fruits, vegetables, fish, and low-fat dairy products are rich in magnesium. They stress that among several protective nutrients, magnesium should be given particular consideration because of the very frequent occurrence of chronic primary magnesium deficiency, which acts as a cardiovascular risk factor.[1]

WHAT ABOUT CALCIUM?

As you can see from the list of calcium in common foods on this page, calcium is plentiful in nuts, seed, whole grains, and leafy green vegetables, just like magnesium, but only if the minerals are already in the soil. In theory, when you eat these foods you are getting a balanced amount of calcium and magnesium. Calcium is also found in seafood and dairy. So if you also eat these foods you shift the balance of calcium and magnesium in favor of calcium. Another important aspect of dietary calcium and magnesium is the effect of processing and cooking on these minerals. More magnesium is lost in food processing and cooking than calcium, so once again, more calcium is found in the diet than magnesium, which strengthens the case for taking magnesium in supplement form in equal amounts with calcium.

ORGANIC FOOD

Factory-farmed food is deficient in magnesium; therefore, organic food is a wiser choice. As more people go this route, whether to avoid herbicide and pesticide residues or to ensure nutrient-dense produce, the cost of organic food is dropping dramatically. However, organic food is not a guarantee of higher magnesium levels. Seek out organic farmers who are educated about crop rotation, test regularly for mineral deficiencies in the soil, and use mineral-rich fertilizers. The smart way to be assured of quality organic food is to join a community-sponsored agriculture (CSA) cooperative and buy a share in a local organic farm every year. Every week for an average of twenty-four weeks in the North, and all year round in the South, you share the harvest, which can include fresh vegetables, fruit, and free-range eggs, chicken, and lamb. (See the Resources section for information on CSAs.)

USDA FINDINGS

United States Department of Agriculture (USDA) surveys of women's diet find that approximately 25 percent of their magnesium is supplied by grain products. This means you should try to include a variety of whole grains and avoid white bread and pasta. If you crave sugar and bread, you may be feeding yeast in your intestines and should try to limit your intake to achieve weight loss and blood sugar balance. Or you may be craving nutrients that your body knows are absent from refined grains—you eat more carbs but the empty calories don't seem to satisfy a deeper need. Remember that you have to eat 25 ounces of white bread to get the RDA of magnesium.

Another 25 percent of women's magnesium intake comes from fruits and vegetables. The high-protein foods—meat, poultry, and fish—provide only about 18 percent of total magnesium intake. Since high-protein diets are now becoming more popular, you must make sure to increase your intake of magnesium when on such a diet. Fats, sweets, and beverages supply 14 percent of the total magnesium intake; however, these foods, especially refined fats and sweets, should be limited because they contain empty calories devoid of nutrients. Nuts and seeds and their butters are the richest sources of magnesium, but they are not even mentioned in most food surveys.

FOODS RICH IN MAGNESIUM

In the Appendix you will find a complete list of foods with their magnesium content. Below is a short list of the richest sources of magnesium.[2] The quality of the soil from which these sources were assayed is unknown. Therefore, use these figures as a rough guide to making wise food choices.

MAGNESIUM CONTENT OF SELECTED FOODS

Food	Magnesium (mg) per 3½ oz (100 g/10 tbsp)
Kelp	760
Wheat Bran	490
Wheat germ	336
Almonds	270
Cashews	267
Molasses	258
Yeast, brewer's	231

Buckwheat	229
Brazil nuts	225
Dulse	220
Filberts	184
Peanuts	175
Wheat grain	160
Millet	162
Pecans	142
English walnuts	131
Rye	115
Tofu	111

HERB SOURCES OF MAGNESIUM

Green plants, including most herbs, such as purslane and cilantro, are loaded with magnesium.[3], [4], [5], [6] Here are some other commonly used magnesium-rich herbs that you can introduce into your diet. Herbs have the added advantage of often being organic or picked wild, so they usually don't contain pesticides and herbicides.

BURDOCK ROOT (*ARCTIUM LAPPA*), 537 MG MAGNESIUM PER 100 G

Master herbalist Matthew Wood describes burdock root as a natural diuretic specifically for flushing out very small kidney stones, an excellent blood cleanser, and a liver detoxifier. It can be grated into salads or cooked like potato and eaten several times per week.

CHICKWEED (*STELLARIA MEDIA*), 529 MG MAGNESIUM PER 100 G

Herbalist Susun Weed describes chickweed as a perfect food with "optimum nutrition." Chickweed encourages absorption of minerals and nutrients and is also naturally high in magnesium. Used several times a week in salads, it provides an excellent source of dietary magnesium.

DANDELION (*TARAXACUM OFFICINALE*), 157 MG MAGNESIUM PER 100 G

This amazing herb has been vilified as a nuisance weed, but its healing properties are legion. According to Andrew Chevallier, an experienced medical herbalist, it is used as a safe, natural diuretic to treat high blood pressure, and as a

detoxifier to remove waste products from the gallbladder and the kidneys, thereby ameliorating many conditions such as gallstones, constipation, acne, eczema, arthritis, and gout. No doubt it owes some of its actions to the properties of magnesium. Dandelion leaves, used in salads, add a necessary bitter property that stimulates the bile. The root can be cooked or grated raw into salads.

DULSE (*PALMARIA PALMATA*), 220 MG MAGNESIUM PER 100 G

Dulse is a type of seaweed, of which there are many kinds; all dietary seaweeds are very nutritious. They are very high in digestible protein, around 25 percent by weight. Iodine to support the thyroid gland is their most notable benefit. They are high in most minerals as well as vitamins. Dulse can be introduced several times a week in soups and stews, and don't forget vegetarian sushi rolls, which are wrapped in seaweed.

NETTLES (*URTICA DIOICA*), 860 MG MAGNESIUM PER 100 G

Nettles are used to soften gallstones or kidney stones in the body. Susun Weed has some excellent recipes for nettles in her book *Healing Wise*. When nettles are lightly steamed they lose their stinging properties and make an excellent vegetable addition to any meal.

MAGNESIUM SALT SUBSTITUTES

Most doctors tell patients with high blood pressure to avoid salt, but they mean sodium chloride. Salt from the sea and salt high in magnesium are not only safe but can be therapeutic for someone with heart disease. They do contain sodium, however, so be sure to read labels.

Celtic Sea Salt is all the rage in gourmet food shops and it should be in your kitchen and dining room as well. Salt from evaporated seawater is relatively high in magnesium and is a wonderful way to get extra magnesium—about 20 mg in a teaspoon. However, the sodium content is still excessively high.

Smart Salt is just that—a smart way to stock up on magnesium. Smart Salt is a product of the United States, produced by evaporation from Utah's Great Salt Lake. It has the following levels of minerals in 3 tsp: 626 mg of magnesium, 865 mg of potassium, and only 1,596 mg of sodium. (A similar amount of table salt contains about 5,000 mg of sodium.)

Cardia Salt offers a healthy combination of salt, potassium, and magnesium that tastes just like regular salt. It produced a reduction in blood pressure in a double-blind placebo-controlled study carried out in 1997 on 233 hypertensive patients on medication. Another half dozen studies have confirmed its safety and effectiveness. Researchers comment that the product works because it reduces the amount of sodium by 50 percent and raises potassium and magnesium levels. For every teaspoon of salt you net about 40 mg of magnesium. The average amount of salt used per day is about 3 tsp, which means a

significant 120 mg of magnesium per day, but, again, the sodium levels are still very high compared to magnesium. See the Resources section for magnesium salt substitutes.

MINERAL WATER AND MAGNESIUM

An important source of magnesium, popular in Europe, is magnesium-rich mineral water. We have only a few local waters in the United States that have high magnesium levels that could help to reduce magnesium deficiency. We must also be careful to consider the calcium content of bottled water in relation to magnesium. A close reading of mineral water labels tells us that the calcium and sodium content is usually much higher than magnesium. Therefore, choose water with equal parts calcium and magnesium. This will ensure that you are getting enough of both minerals. If, however, you know you have a magnesium deficiency, by your symptoms or from medical or naturopathic diagnosis, choose water with high magnesium and low calcium content. Be aware that even though a label says "mineral water," the mineral content may be minuscule and not worth the price you pay.[7]

Another important aspect of drinking water that I discuss with clients in my telephone consulting practice is whether it is acid or alkaline. Our bodies are 70–90 percent water, so finding ways to increase the alkalinity of the body is vital to health.

MAGNESIUM IN WATER[8]

Water Name	Country	Magnesium (mg/L)	Calcium (mg/L)	Sodium (mg/L)
Adobe Springs	USA	96	3.3	5
Santa Ynez	USA	87	19	—
San Pellegrino	Italy	57	203	46
Penafiel	Mexico	41	131	159
Vittel	France	38	181	3.7
Evian	France	24	78	5
Naya	Canada	22	38	6
Volvic	France	7	10	10.7
Saratoga	USA	7	64	9
Perrier	France	5	143	15.2
Alhambra	USA	5	9.5	5.4
Arrowhead	USA	5	20	3
Sparkletts	USA	5	4.6	15.2
Calistoga	USA	2	8	163
Cobb Mountain	USA	2	5.6	4.6
Poland Spring	USA	2	13.2	8.9
Sante	USA	1	4.2	160
Black Mountain	USA	1	25	8.3
Crystal Geyser	USA	1	1.5	30

A MAGNESIUM EATING PLAN

Upon rising: Juice of ½–1 fresh lemon in warm water. Sweeten with stevia.

BREAKFAST

Crockpot cereal with flaxseed oil and fresh or frozen blueberries, strawberries, raspberries, banana, peach, or pear

Choose two grains, one nut, one seed from: buckwheat, millet, rye, oats, amaranth, quinoa, sunflower seeds, pumpkin seeds, almonds, cashews, filberts, walnuts, pecans

For one person, put 2 oz of dry mixture in 5 oz of water in a 1-quart crockpot. Cook overnight. In the morning place in a bowl, add 2–4 oz of fruit, mix, and add 2 tbsp flaxseed oil *or* 1 tbsp butter (organic), *or* 2 tbsp ground flaxseeds (ground fresh in a coffee grinder). You may add rice milk, almond milk, or small amounts of soy milk as needed. For extra magnesium, sprinkle on wheat germ (kept in the freezer).

Substitutions:

1. Instead of using a crockpot, you can soak 2 oz of grain mixture overnight in 5 oz of water, with or without 2 tbsp of plain yogurt. In the morning bring to a boil and let simmer on the lowest setting for 20 minutes. You may have to add more water to avoid dryness. Serve with 2 tbsp ground flaxseeds (ground

fresh in a coffee grinder).

2. Instead of soaking overnight, cook 2 oz of grain mixture in 6 oz of water. Bring to a boil and let simmer for 30 minutes.

LUNCH (*Choose one*)

Brown rice and vegetables, cooked with 2 oz dulse or other sea vegetables

Leafy green salad, soup with added sea vegetables, and Essene sprouted bread or Ezekiel bread

Fish, greens (collards, spinach, swiss chard), and salad

Egg omelet with sautéed vegetables

Chicken with vegetables

DINNER (*Choose one*)

Soup (with sea vegetables) and salad

Stir-fried grains (leftover grains from breakfast) and vegetables

Roasted vegetables with wild rice

Salad with cooked organic legumes (kidney beans, lentils, black beans, pinto beans, chickpeas)

Wheat-free pasta (rice, spelt, kamut) with pesto, tomato sauce, and green vegetables

Mixed salad with avocado

SNACKS

Raw vegetables
Dried fruit (prunes and figs)
Shelled nuts and seeds (raw, not processed or salted)
Baked blue corn chips
Popcorn

DRINKS

Pure, clean water
Green tea
Freshly squeezed lemon juice and water
Cranberry juice sweetened with stevia
Herbal teas
Kukicha (roasted twig tea)
Bone broth (see recipe this page)

THE MAGNESIUM DIET

- Eat a wide variety of vegetables daily. Always include greens such as kale, collards, spinach, and curly-leaf lettuce, and magnesium-rich herbs such as dandelion, chickweed, and nettles.
- Enjoy starchy vegetables three or four times a week, such as red-skinned potatoes, winter squash, corn on the cob, lima beans, and burdock root.
- Eat fruits moderately.
- Include a variety of whole grains: buckwheat, millet, rye, oats, amaranth, and quinoa.
- Fish, shellfish, organic chicken, meat, turkey, or free-range eggs can be eaten once a day as rich animal protein sources.
- Have beans, tempeh, nuts, seeds, and legumes as a vegetarian source of protein daily.
- Use fresh and dry herbs in your cooking and include lots of garlic.
- Use organic cold-pressed oils for your cooking: extravirgin olive oil, coconut oil, and sesame oil.
- Use organic butter in moderation.
- Take 1–2 tbsp of flaxseed oil daily.
- Use whole-grain breads and pasta.
- For sweetener use stevia.
- Drink natural spring, distilled, or filtered water only.
- Enjoy organic herbal teas.

- Eat sea vegetables: dulse, nori, arame, wakame, kombu, and hijiki. All are exceedingly high in magnesium.
- Use natural raw, unheated nuts, seeds, and nut and seed butters, rich magnesium sources.
- Use a high-quality mineral-rich sea salt.

Bone Broth: Drink 1 cup a day on the days you need to increase your calcium intake.

- 2 pounds (or more) of organic bones (beef, chicken, fish)
- 1 onion
- 2 carrots
- 2 stalks of celery
- 2 tablespoons apple cider vinegar (this is mandatory)

Optional: 1 tbsp sea salt, herbs or spices to taste. Two cloves of garlic and parsley in the final 30 minutes. Bring to a boil and simmer:

- Beef broth/stock: 48 hours
- Chicken or poultry broth/stock: 24 hours
- Fish broth: 8 hours

Remove from heat and let cool. Use a fine metal strainer to remove all bone and vegetable. When cool enough, store in the fridge for up to 5 days, or freeze for later use.

FOODS TO AVOID (read labels thoroughly)

- All refined and processed foods of any kind, such as cookies, cakes, doughnuts, bagels, white bread, luncheon meats, and soy protein powder.
- All refined and processed sugars, including fructose or corn syrup and diet products with artificial sweeteners such as aspartame (NutraSweet and Splenda).
- All dairy products except organic butter and free-range eggs.
- Regular and decaffeinated coffee or black tea.
- Any foods containing hydrogenated or partially hydrogenated oils or trans fatty acids.
- All alcoholic beverages.
- Pasteurized fruit juices and sodas.
- Foods containing MSG, hydrolyzed vegetable protein, and chemical preservatives.
- Commercial iodized salt.

CHAPTER EIGHTEEN

MAGNESIUM SUPPLEMENTATION AND HOMEOPATHIC MAGNESIUM

When you take supplements it can be a real challenge to find out how much actual or elemental magnesium is available in each pill or capsule and even harder to find out how much you need. Magnesium does not exist alone in nature but comes combined with other substances. That other substance, tagging along with magnesium, has a specific weight. For example, 1,000 mg of magnesium citrate, the mostly commonly used form of magnesium, offers 125 mg of elemental magnesium. When reading the label, the amount of elemental magnesium is what you want. The best forms are picometer magnesium, magnesium taurate, magnesium glycinate, magnesium citrate, magnesium malate, magnesium orotate, and transdermal magnesium oil.

There is one more thing to be aware of on product labels, which is the specification of dosage. All too often people will find that they have to take not one but three or six tablets to make up the dosage on the label. It may be in small print, but read it carefully to understand exactly what each tablet contains.

MAGNESIUM DOSAGE

To individualize your magnesium dosage, the rule of thumb for men and women is 6–8 mg/kg (3.0 to 4.5 mg/lb) of body weight per day. That translates into a total dietary and supplemental magnesium of 600 to 900 mg per day for a 200-lb man. Some researchers recommend 10 mg/kg/day for children because of their low body weight and increased requirements for growth and 6–10 mg/kg/day for athletes, depending on stress and training levels.[1], [2], [3], [4] However, serial testing of Magnesium RBC levels and seeking the optimum blood level of 6.5 mg/dL may be the only way to ensure magnesium repletion.

CONTRAINDICATIONS TO MAGNESIUM THERAPY

1. *Kidney failure*. With kidney failure there is an inability to clear magnesium from the kidneys.

2. *Myasthenia gravis*. Intravenous administration could accentuate muscle relaxation and collapse the respiratory muscles.

3. *Excessively slow heart rate*. Slow heart rates can be made even slower, as magnesium relaxes the heart. Slow heart rates often require an artificial pacemaker.

4. *Bowel obstruction*. The main route of elimination of oral magnesium is through the bowel.

THE SAFETY OF MAGNESIUM SUPPLEMENTS

For the average person, oral magnesium, even in high dosages, has no side effects except loose stools, which is a mechanism to release excess magnesium. Excess magnesium is also lost through the urine. Even non-laxative picometer magnesium will cause the laxative effect when you reach saturation and take more than you require.

TYPES OF MAGNESIUM

ORAL SUPPLEMENTS

Bones are a storage site for magnesium. Therefore, bone meal is labeled a rich source of magnesium. But, the calcium content of bone meal is about ten times higher making it unsuitable because all that calcium will negate the effects of magnesium. Also, since 1945, radioactive strontium 90, along with lead and a variety of other toxic elements, began to show up in our bones and in the bones of cattle, from which bone meal is produced. Dolomite was widely promoted in the past because it contained calcium and magnesium, however it has double the amount of calcium compared to magnesium making it unsuitable.

When you look at the amount of elemental magnesium in various supplements, you see that magnesium oxide seems to have a higher amount of available magnesium; however, studies have shown that only about 4 percent of that amount is absorbed. We are told that about 50 percent of magnesium in foods and water is absorbed. All other supplements range somewhere in between.

Chelated magnesium, bound to organic amino acids, is better absorbed than magnesium oxide but is more expensive. Complementary medicine practitioners rely on chelated magnesium, such as magnesium glycinate, taurate, and orotate, to treat serious cases of magnesium deficiency. Dr. Russell Blaylock warns that magnesium aspartate may offer the body too much aspartic acid, an amino acid that causes brain stimulation; he recommends avoidance.

Picometer magnesium is a non-laxative liquid form of

magnesium that is fully absorbed at the cellular level making it highly therapeutic. *Magnesium citrate* is the most widely used magnesium supplement because it's inexpensive, quite palatable, and only has a mild laxative effect. The best form is a magnesium citrate powder mixed in water that can be taken every day. However, if you walk into your average pharmacy and ask for magnesium citrate, you will be directed, usually in a loud voice, to bowel-purging laxatives. I learned about citrate salts in medical school; in large amounts they are used to completely purge the bowel before bowel X-rays, barium enemas, sigmoidoscopies, or colonoscopies. For example, the total amount taken daily as a magnesium citrate supplement is about 600 mg. However, 12,000 mg is the amount given for a bowel purge! If your pharmacist doesn't know the difference between a magnesium citrate supplement and a bowel-purging laxative, just go down the street and find a health food store, which is sure to have magnesium citrate in powder as well as capsules.

FORMS OF MAGNESIUM

Inorganic salts	**Organic salt chelates**
Magnesium bicarbonate	Dimagnesium malate
Magnesium carbonate	Magnesium adipate

Magnesium chloride	Magnesium aspartate
Magnesium oxide	Magnesium citrate
Magnesium phosphate	Magnesium glutamate
Magnesium sulfate	Magnesium glycinate
	Magnesium lysinate
	Magnesium malate
	Magnesium orotate
	Magnesium taurate

MAGNESIUM CONTENT OF VARIOUS SUPPLEMENTS

Magnesium Salt	Amount of Elemental Magnesium per 500 mg Salt
Magnesium oxide	300 mg
Magnesium carbonate	150 mg

Dimagnesium malate	95 mg
Dolomite	75 mg
Magnesium citrate	75 mg
Magnesium malate	75 mg
Magnesium chloride	60 mg
Magnesium lactate	60 mg
Magnesium glycinate	50 mg
Magnesium sulfate	50 mg
Magnesium taurate	50 mg
Magnesium orotate	30 mg

Magnesium gluconate	25 mg

MAGNESIUM SUPPLEMENT ABSORPTION

The amount of magnesium your tissues can readily use is based on how soluble the magnesium product is and the amount of elemental or ionic magnesium that is released. A value, called a stability constant, is placed on all metal-ligand complexes. Magnesium citrate is a metal-ligand complex; the metal is magnesium and the ligand is citric acid. Magnesium taurate is a metal-ligand complex composed of the metal magnesium and the ligand taurine. Stability constants range from less than one into the teens. If a metal-ligand has a very low stability constant (less than 1), the metal-ligand is readily soluble in water and also easily dissociates into the metal ionic form shown and the ligand. This means your body is able to absorb the metal ingested in ionic form at a pH as low as stomach acid (about pH 2 to 3) to as high as pH 7.4, which is the pH of the main extracellular body fluids such as serum and lymph.

There are three ranges of stability constants and absorption.

- Metal-ligand complexes with stability constants of 3 and lower are soluble and substantially ionized at physiologic pH 7.4.

- Metal-ligand complexes with stability constants over 3 and perhaps as high as 6 are likely to disassociate in stomach acid, but not greatly at physiologic pH 7.4.
- Metal-ligand complexes with stability constants above 6 release less metal regardless of how low the pH may be, and such compounds are essentially useless in biological systems.

To simplify this complex system, in order for minerals to be biologically available for human and animal use, they should not be associated with ligands where the stability constant is greater than 4.0.

The stability constants of amino acid complexes of many biologically important metals are in the 3 to 4 range and are highly absorbed even though they are not necessarily broken down by acids.

Magnesium Complex	**Stability Constant**	**Ionization**
Magnesium chloride	0	(totally ionized)
Magnesium acetate	0.51	(essentially ionized)
Magnesium gluconate	0.70	(essentially ionized)

Magnesium lactate	0.93	(essentially ionized)
Magnesium malate	1.55	(essentially ionized)
Magnesium glutamate*	1.90	(essentially ionized but neurotoxic)

*Avoid magnesium glutamate; it breaks down into the neurotransmitter glutamic acid, which without being bound to other amino acids is neurotoxic. Glutamic acid is a component of aspartame, which should also be avoided.

Magnesium aspartate*	2.43	(essentially ionized but neurotoxic)
Magnesium citrate	2.8	essentially ionized
Magnesium glycinate	3.45	

*Avoid this form; it breaks down into the neurotransmitter aspartic acid, which without being bound to other amino acids is neurotoxic. Aspartic acid is a component of aspartame, which also should be avoided.

Reference: george-eby-

research.com/html/stability_constants.html. *Note:* On this site taurine is not listed, and orotic acid does not have a stability constant associated with magnesium, so they were not included.

Magnesium taurate, glycinate, and orotate are amino acid chelates of magnesium that have less laxative effect on the intestines than magnesium citrate, so they are recommended if you tend to have loose stools. The safest magnesium for people who cannot take any oral magnesium is picometer magnesium, which has no laxative effects. *Magnesium taurate* is a combination of the amino acid taurine and magnesium that has special properties for the heart. Taken together in this combination, magnesium and taurine have a synergistic effect, stabilizing cell membranes, calming the nervous system, and inhibiting nerve excitation. Taurine also transports magnesium across cell membranes, making this form of magnesium highly absorbed. In a series of studies published since the early 1970s it appears that the amino acid taurine is important for heart health and may prevent arrhythmias and protect the heart against the damage caused by heart attacks.[5], [6]

Magnesium chloride is a form of magnesium that comes in capsules, powder, picometer magnesium, and IV solution. Some say it may be the best magnesium for ingestion. That's because minerals need to be dissolved in gastric acid to go into solution. And, magnesium chloride has extra chloride molecules to produce hydrochloric acid in the stomach to enhance its absorption. In the stomach,

there is normally sufficient hydrochloric acid present, but if you take a lot of antacid products, the chemical conversion can be compromised.

Dr. José Luis Pérez Albela, director of the Instituto Bien de Salud in Lima, Peru, is an ardent proponent of magnesium and uses magnesium chloride exclusively. He spreads the word on his radio show, in public lectures, to his colleagues, and to his patients. He manufactures and distributes small one-dose packets of magnesium chloride, often giving them away to needy people. To overcome the bitter taste, he tells people to stir the powder in citrus juice. Or you can put a drop of lemon or orange essential oil in a glass of water and stir in the powder. Success stories with magnesium from Dr. Albela's patients and friends could fill a book. Magnesium chloride is the form of magnesium used to make magnesium oil.

Magnesium malate combines magnesium with malic acid, a weak organic acid found in vegetables and fruit, especially apples. The weak bond with magnesium makes it readily soluble in the body. Malic acid is a key component of several energy-making chemical reactions in the body. Researchers have used magnesium malate successfully to treat the chronic fatigue, pain, and insomnia of fibromyalgia. Dimagnesium malate increases the amount of magnesium available to the body; it has the same properties as magnesium malate.

Magnesium oxide appears to have a high amount of elemental magnesium. One 500-mg capsule of magnesium oxide contains 300 mg of elemental magnesium. But little of that amount is available to the body because it is not

absorbed and therefore not biologically available. One recent study reported a 4 percent absorption rate of magnesium oxide. This means 12 mg of a 500 mg capsule are absorbed and 288 mg stay in the intestines, acting like a laxative. Most medical research done on magnesium employs magnesium oxide. Imagine how much more favorable the results would be if a more absorbable form of magnesium like picometer magnesium were used.

There are several ways to enhance absorption besides choosing an absorbable product. If you have digestive problems with symptoms of gas and bloating, which indicates a lack of hydrochloric acid, you may need to take a digestive aid such as betaine hydrochloride to help absorb your minerals. Magnesium can be taken with or without meals, but it's preferable to take it between meals for better absorption. Magnesium requires stomach acid to be absorbed. After a full meal, your stomach acid is busy digesting food and may not be available to help absorb the magnesium. Also, magnesium is an alkaline mineral and acts like an antacid; taken with meals, it may neutralize stomach acid and impair digestion.

If you develop loose stools while taking magnesium, it does not necessarily mean you are absorbing enough and losing the rest; it may mean you are taking too much at one time. Never take your daily magnesium all at once. Spread it out through the day; four times a day is best if you've been experiencing diarrhea. If that doesn't do the trick, you probably need to cut back the amount you're taking or switch to a picometer form of magnesium. Spraying with magnesium oil for at least half your daily supplement will

often banish loose stools.

Remember that when you first begin taking magnesium, you may need a high amount to remedy an existing deficiency, but over time that deficiency will be eliminated and you will need less. *Note:* If you are taking a multivitamin-mineral, remember to check the amount of elemental magnesium on the label and count it in your daily total. Also watch for too much calcium. And if you follow the magnesium eating plan in Chapter 17, the extra magnesium in your diet means you will require less in supplement form.

MAGNESIUM OIL

A very exciting addition to the magnesium family is a product loosely referred to as magnesium oil. It's not actually an oil at all, but a supersaturated solution of magnesium chloride in water. Magnesium oil can be sprayed or rubbed on the body and is readily absorbed through the skin. It helps greatly to increase the amount of magnesium in body tissues and overcomes the problems that some people have with loose stools when they try to take enough magnesium to meet their needs. This can be especially important in cases of severe magnesium deficiency that were treatable only with IV magnesium before magnesium oil came along.

Norman Shealy, M.D., Ph.D., neurosurgeon and world-renowned pain management expert, confirms that sufficient magnesium is notoriously difficult to absorb orally when it acts like a laxative. He says that if magnesium goes through the intestines in less than twelve hours, absorption of the mineral is seriously impaired. It's excreted faster than it can be absorbed. Dr. Shealy is also convinced that even the best oral preparation, which he considers to be magnesium taurate, requires oral supplementation for six to twelve months to restore intracellular levels. But he finds that skin application of magnesium oil with a concentration of 25 percent magnesium chloride restores intracellular levels within four to six weeks. Dr. Shealy has produced a small study to support his findings.

According to Mark Sircus, O.M.D., who writes about magnesium oil in *Transdermal Magnesium Therapy* (Phaelos Books, 2006), the amount of magnesium in one

spray of a 25 or 35 percent solution of magnesium chloride is between 13 and 18 mg. Therefore, if you pump about 6 sprays for each leg and arm, you are applying about 400 mg of magnesium—the RDA. Another 6 sprays front and 6 back equals 600 mg. If the magnesium oil tingles or burns slightly, you can dilute it half and half with distilled water. This cuts the dosage in half, so you need to use twice as many sprays to get 600 mg. After about thirty minutes, most of the magnesium has already been absorbed, so if the oil feels a bit itchy when it dries, you can wash it off in a quick shower, or just simply wash the itchy areas with a washcloth. Picometer magnesium spray does not produce any itchiness. Oil or picometer magnesium sprayed and dried 4–5 times on a painful area can eliminate pain.

MAGNESIUM SHOTS

In her book *Diagnosing and Treating Chronic Fatigue Syndrome*, Sarah Mayhill, M.D., in the U.K., administers magnesium intravenously (IV) and intramuscularly (IM). She uses 2 ml, which is less than half a teaspoon, of 50 percent magnesium sulfate, equal to only 100 mg of elemental magnesium, IM or IV every two weeks for her chronic fatigue patients. Such a shot, into muscle, can be painful. It is given slowly over one to two minutes. It goes directly into the bloodstream through small capillaries and can make you feel hot, flushed, and anxious, as it causes a generalized dilation of all the blood vessels in the body, but this is in no way harmful.

Intravenous magnesium should be used immediately at the onset of a heart attack or stroke. These conditions are due to a blockage and spasm of arteries, and the vasodilation produced is extremely beneficial. The dosage is 2–5 ml of 50 percent magnesium sulfate injected directly into a vein giving 100–250 mg of elemental magnesium. Most clinical trials using magnesium offer this dose. Picometer magnesium taken orally is shown to be even more effective in raising magnesium levels than IV magnesium. Magnesium oxide, hydroxide, and carbonate are not soluble and only very slightly bioavailable. They act mainly as laxatives, leaving almost no magnesium to be absorbed. If you take a magnesium tablet or capsule and get loose stools, then you know it's not being absorbed but sweeping through your intestines, pushing everything along with it.

Picometer magnesium, then IV magnesium, then

magnesium oil are the most absorbable forms of magnesium in that order. Next come magnesium glycinate, magnesium taurate, and magnesium orotate. A very close fifth is magnesium citrate, but since it's usually cheaper than other oral forms, it's become the most popular. Magnesium oxide is a distinct sixth and very poorly absorbed, but it makes a great laxative.

WHEN TO TAKE MAGNESIUM

Take your first dose of magnesium when you wake up in the morning and the last dose at bedtime. If you take a third dose, make it late in the afternoon. Magnesium is most deficient in the early morning and late afternoon. A very few people feel that magnesium is sufficiently energizing that it keeps them awake at night, but most people find it as good as a sleeping pill to help them get a good night's rest. Others, who suffer from leg cramps, restless legs, fibromyalgia, or general muscle tension, take magnesium at night and find that it diminishes pain and tension and helps them sleep. There are so many ways that magnesium can work on the body that it is important for you to decide what timing is best for you.

MAGNESIUM AS A LAXATIVE

Oral doses of magnesium sulfate (Epsom salts), magnesium hydroxide (milk of magnesia), magnesium oxide, and magnesium citrate contain high concentrations of magnesium to draw water into the colon and act as an effective laxative. But it's all a matter of dose. As a laxative, 1,000–2,000 mg of milk of magnesia provides an effective dose; however, as a magnesium supplement, doses of 200–600 mg are more common. These salts are, in fact, gentler than cascara and senna, herbs that cause muscle contraction of the intestinal wall. In *IBS for Dummies* (Dean and Wheeler, 2005), we talk about magnesium as an excellent treatment for IBS constipation as a daily supplement to prevent the problem from occurring.

Laxatives, in general, are not recommended because you can become dependent on them and they can flush out beneficial intestinal bacteria and electrolytes. It is far better to supplement the diet with magnesium-rich foods and, if necessary, magnesium supplements to relax the bowel and allow normal action. Magnesium laxatives are contraindicated in patients with nausea, vomiting, appendicitis, intestinal obstruction, undiagnosed abdominal pain, or kidney disease.

Epsom salts in a bath are absorbed slightly and are known to be relaxing. I remember one patient, Arlene, as "the woman who soaked too long." She put several pounds of Epsom salts in a bath, soaked for two hours, and found out that magnesium sulfate is indeed absorbed through the skin: she developed diarrhea due to magnesium's laxative effect. Someone with a skin condition such as eczema

might absorb magnesium even more readily. Limit your soak to thirty minutes and follow the directions on the label for how much Epsom salts to add to your bath (as a general rule, use no more than 2 cups at a time).

CALCIUM AND MAGNESIUM INTERACTION

Too much calcium will impede magnesium uptake and function. Push aside the media-generated hype on calcium and look at the facts. A thousand years ago our diet favored magnesium over calcium. Now, however, we tend to get far more calcium in our diets than magnesium. There has been unsupported information that two parts calcium to one part magnesium was beneficial.[7] However, read this page in the Introduction for the latest research showing the dangers of calcium supplementation and reasons why we have become a calcified world. If you have definite magnesium deficiency symptoms, take even twice the amount of magnesium to dietary calcium until your symptoms abate. If you do take too much magnesium, you will experience the fail safe of increased bowel movements as it flushes out of the body. As mentioned above, if you can't seem to get enough magnesium without having loose stools, then add ReMag and magnesium oil to your regimen. Use the Magnesium RBC test to follow your magnesium status making 6.5 mg/dL the optimum value to aim for.

MAGNESIUM'S INTERACTION WITH OTHER NUTRIENTS

Magnesium is extremely important for the metabolism of calcium, potassium, phosphorus, zinc, copper, iron, sodium, lead, cadmium, hydrochloric acid, acetylcholine, and nitric oxide, as well as for the activation of vitamin B_1 and therefore for a very wide spectrum of crucial body functions.[8] A shift in any one of these nutrients has an impact on magnesium levels and vice versa. It is the interwoven nature of the body's components that makes it so difficult to isolate one substance to scientifically "prove" what it can do. Magnesium cannot be taken out of context either in a research setting or in your body. For example, you should increase magnesium intake when you consume more phosphorus and vitamin D. Magnesium is necessary to convert dietary vitamin D into one of the hormones that makes efficient use of calcium in bone formation.[9], [10] Vitamin B_6 increases the amount of magnesium that can enter cells; as a result, these two nutrients are often taken together. In one experiment, serum vitamin E levels improved after magnesium supplementation.[11] We also know that magnesium and the essential fatty acids (EFAs, found in fish, nuts and seeds, and flaxseed oil) are interdependent; each works much more efficiently when the other is present in sufficient amounts.

HOMEOPATHIC MAGNESIUM: ANOTHER FORM OF MAGNESIUM

Developed by Samuel Hahneman in the early nineteenth century, homeopathy is a natural medical science that uses mostly plants and mineral extracts diluted in alcohol or water to infinitesimal amounts in order to stimulate the individual's natural healing response. Research has shown that these substances, if given in a toxic amount, can cause symptoms similar to those that the patient is experiencing, but that the infinitesimal dose can cure those symptoms. After two hundred years of clinical use and observation, homeopathy is now more successful than the tools we have available to measure how it works. Although skeptics often attribute its success to the placebo effect, in which a patient's belief in an outcome produces that outcome, the millions who have benefited from homeopathy include infants and animals, two groups that are clearly not susceptible to the placebo effect.

Nonetheless, in America homeopathy continues to be marginalized in favor of other drugs, even in the face of such early evidence as the influenza epidemic of 1919, in which the homeopathic hospitals in England showed a greater cure rate than conventional hospitals. In Europe, both homeopathic medicine and herbal medicine enjoy a respected place in the health care system.

Homeopathic remedies typically come in dosages of 6, 12, or 30 X (10) or C (100) potency. The higher the number, the greater the dilution and the more potent the remedy. Usually, you take three pellets or four drops of a remedy several times a day. For a very acute, painful

symptom, a dose can be taken every fifteen minutes. However, if after taking five or six doses of a remedy there is no change in symptoms, the remedy is probably ineffective and you should seek a new one. Be assured that treating with the wrong remedy a half dozen times does not cause any negative side effects.

In homeopathy, magnesium is used primarily for acute muscle spasms or chronic complaints.[12] Please consult a homeopath for a more detailed evaluation of your case.

Magnesia phosphorica (magnesium phosphate, or mag phos) is a great antispasmodic remedy and the most commonly used magnesium homeopathic remedy. It readily treats cramping of all muscles, including hiccups, leg cramps, writer's cramp, abdominal colic, heart pain, lung pain, menstrual pain accompanied by radiating pains, neuralgic pains, and all sorts of tics and tremors including twitching of the eyelids. It works especially well in debilitated subjects who are both mentally and physically tired.

Dr. Margery Mullins, an internist and acupuncturist, told me about the success she has had with the use of magnesium phosphate for muscle spasms with her patients. She said patients would get instant relief and then didn't seem to need the remedy after their magnesium deficiency was corrected with diet and supplements. One of her young patients, a nine-year-old girl, was having such severe muscle spasms that she was referred to a pediatric neurologist. In the interim, Dr. Mullins gave her Magnesia phosphorica 6X, and by the time of her appointment with the specialist the child no longer had the problem. Dr.

Mullins noted that the girl's mother had had toxemia (eclampsia) during her pregnancy, requiring intravenous magnesium.

To the Miracle Women in my life: my mum, Rena; my three sisters, Chris (who labored with me on the first drafts of "the wee maggie"), Anne, and Evelyn; and my agent, Beth.

Thank you all.

APPENDIX

MAGNESIUM CONTENT OF COMMON FOODS

Food	Magnesium (mg) per 3½ oz (100g) serving
Kelp	760
Wheat bran	490
Wheat germ	336
Almonds	270
Cashews	267
Molasses	258
Yeast, brewer's	231
Buckwheat	229
Brazil nuts	225
Dulse	220
Filberts	184

Peanuts	175
Millet	162
Wheat grain	160
Pecan	142
English walnuts	131
Rye	115
Tofu	111
Coconut meat, dried	90
Brown rice	88
Soybeans, cooked	88
Figs, dried	71
Apricots	62
Dates	58
Collard greens	57
Shrimp	51
Corn, sweet	48

Avocado	45
Cheddar cheese	45
Parsley	41
Prunes, dried	40
Sunfower seeds	38
Barley	37
Beans, cooked	37
Dandelion greens	36
Garlic	36
Raisins	35
Green peas, fresh	35
Potato with skin	34
Crab	34
Banana	33
Sweet potato	31

Blackberry	30
Beets	25
Broccoli	24
Cauliflower	24
Carrot	23
Celery	22
Beef	21
Asparagus	20
Chicken	19
Green pepper	18
Winter squash	17
Cantaloupe	16
Eggplant	16
Tomato	14
Milk	13

CALCIUM CONTENT OF COMMON FOODS

Food	Mg Calcium
Vegetables	
½ cup cooked spinach	88
1 cup cooked dried beans (white, kidney, soy, and so on)	95–110
½ cup cooked kale	103
½ cup cooked collards	110
1 cup cooked turnip greens	126
½ cup cooked dandelion greens	147
½ cup cooked beet greens	157
1 medium stalk broccoli	158
1 cup bok choy (Chinese cabbage)	252
Baked Goods and Ingredients	
1 slice whole-wheat bread	50
1 medium waffle	76
1 medium corn muffin	96

½ cup soy flour	132
1 tablespoon blackstrap molasses	140
Seafood	
¾ 8-oz can clams	62
6 scallops	115
½ 7-oz can salmon with bones	284
20 medium oysters	300
7 sardines with bones	393
Nuts and Seeds	
½ cup sesame seeds	76
½ cup Brazil nuts	128
½ cup almonds	175
Fruit	
½ cup cooked rhubarb	200
Dairy	
Yogurt, plain, low-fat, 8 ounces	415

Mozzarella, part skim, 1.5 ounces	333
Yogurt, fruit, low-fat, 8 ounces	350
Cheddar cheese, 1.5 ounces	307
Milk, nonfat, 8 ounces	299
Soymilk, calcium-fortified, 8 ounces	299
Milk, reduced-fat (2% milk fat), 8 ounces	293
Milk, buttermilk, low-fat, 8 ounces	284
Milk, whole (3.25% milk fat), 8 ounces	276
Cottage cheese, 1% milk fat, 1 cup	138
Frozen yogurt, vanilla, soft serve, ½ cup	103
Ice cream, vanilla,½ cup	84
Sour cream, reduced fat, cultured, 2 tablespoons	31
Cheese, cream, regular, 1 tablespoon	14

RESOURCES

MAGNESIUM PRODUCTS

Updated information on safe and effective magnesium products can be found on Dr. Dean's website www.drcarolyndean.com under Resources.

RELOX PROCEDURE

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MAGNESIUM TESTING

Magnesium RBC testing is available online through www.RequestATest.com or www.DirectLabs.com. The optimum levels are from 6.0 mg/dL to 6.5 mg/dL.

EXATest is a rather expensive mineral test usually run in chiropractic and naturopathic offices.
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CHAPTER 1: THE CASE FOR MAGNESIUM

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